Attachment #95.7.2

Assessment of Septic System Design Criteria on Coastal Habitats and Water Quality

A Final Report to

The New Hampshire Office of State Planning, New Hampshire Coastal Program

Submitted by

Dr. Stephen H. Jones[1,2], Dr. Richard Langan[1,3], Dr. Larry K. Brannaka[4],
Dr. Thomas P. Ballestero[4] and Mr. Daniel Marquis[1,2]

[1]Jackson Estuarine Laboratory, University of New Hampshire
[2]Department of Natural Resources, University of New Hampshire
[3]Department of Zoology, University of New Hampshire
[4]Department of Civil Engineering, University of New Hampshire

July, 1996

This Report was funded in part by a grant from the Office of State Planning, New Hampshire
n, as authorized by the National Oceanic and Atmospheric Administration (NOAA),
lumber NA57OZ0320

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This study focused on assessing the design criteria for septic systems as it affects environmental contamination with nutrients and fecal-borne bacteria. Groundwater and surface water samples were collected and analyzed to determine the spatial and temporal trends for contaminants at 11 sites in Seabrook, where all houses with septic systems will soon be connected to a municipal wastewater treatment system. The groundwater flow directions at sites were influenced by loading, seasonal rainfall events and tides, especially the sites on River St. Flow direction changed significantly, making placement of study wells in contaminant plumes difficult. Eventual hydraulic conductivity measurements generally confirmed that study wells were in or near the path of groundwater flow downgradient from effluent disposal areas (EDAs) and likely in plumes. Fecal-borne bacteria and dissolved inorganic phosphorus, and nitrogen were detected, sometimes at high concentrations, in the groundwater below and close to the EDAs at the different sites. The concentrations of the contaminants decreased with distance from and depth below the EDAs. The required 48 inches separating the bottom of EDAs from the seasonal high water table, as required in the design of septic systems, was not met at any site. Many of the sites exhibited much higher groundwater levels, a condition that was conducive to enhanced groundwater contamination. The surrounding surface waters in Seabrook and Hampton Harbor generally exhibited elevated levels of contamination, espeically in the tidal creeks nearest to high density housing developments with septic systems. A combination of water and soil analysis demonstrated recent and more long-term contamination of soils and groundwater downgradient from some of the EDAs in the direction of surface waters, suggesting that septic systems are in deed sources of contmainants to surface waters in coastal New Hampshire.

INTRODUCTION

Nonpoint sources of pollution continue to be a major cause of surface water quality degradation throughout the United States. Important nonpoint pollution sources(NPS) include: pesticides and fertilizers from agricultural runoff, urban runoff, road salting, and failed septic systems. It has been estimated that NPS pollutants account for 73% of the total biochemical oxygen demand (BOD), 83% of the bacterial loads, and 92% of the suspended sediments in waterways of the U.S. (Clark et al., 1985).

Nonpoint source pollutants can cause nutrient enrichments of surface waters which may lead to proliferation of nuisance algae, fish kills, and shifts in microbial populations that favors the growth of human pathogens. Bacterial contamination from NPSs can threaten recreational water uses and harvesting of shellfish resources. In addition, suspended sediments may reduce aquatic vegetation and enhance the survival of microbial pathogens by reducing the lethal effects of light.

Many nonpoint sources, such as agricultural runoff, have been carefully studied and their impacts to ground and surface waters have been well documented (Hilleman, 1990). The vast majority of literature on-site sewage disposal systems (septic systems) has focused on groundwater contamination(Canter and Knox, 1985; Cogger, 1988; Hagedorn et al., 1981; Wilhelm et al., 1994). Studies of on-site sewage disposal systems have shown that they do contaminate groundwater; an estimated 43% of disease outbreaks traced to untreated groundwater were caused by intrusion of sewage from on-site systems (Craun, 1985). With nearly 33% of all homes in the U.S. using septic systems, there is the potential for serious ground and surface water pollution. There is a clear need to assess whether surface waters are impacted from groundwater contaminated by on-site residential septic systems.

During the past two decades the State of New Hampshire has spent nearly $120 million in the seacoast region for upgrading and building new wastewater treatment plants (NHDES, 1995). Despite these efforts bacterial levels remain too high to open many closed shellfish beds (NHDES, 1994). From 1989 to 1994, most of the shellfish growing areas of New Hampshire including Little Harbor, Rye Harbor, Hampton Harbor, and most of the Great Bay Estuary, had been closed. Recent efforts by the state have resulted in the re-opening of some areas, including a large area of Little Bay and a conditionally-approved area in Hampton Harbor.

Both the New Hampshire Office of State Planning and the Department of Environmental Services suspect a link between water pollution in shellfish growing areas and on-site sewage disposal systems. Their suspicions are well documented. A 1989 New Hampshire Nonpoint Source Pollution Assessment Report cited septic systems as, a pervasive nonpoint source pollution concern (NHDES, 1990). In addition, the 1994 New Hampshire Water Quality Report to Congress stated that water quality problems remain with the shellfish waters of the bays and estuaries along the coast due to the violations of the bacterial standard (NHDES, 1994).

This study focuses on the impacts of on-site residential sewage treatment (septic systems) on coastal New Hampshire ground and surface waters. The town of Seabrook, N.H. provides a unique opportunity to conduct such a study. Presently, all of the residences in this coastal community dispose of wastewater through on-site sewage disposal systems. By mid-1996, at which time a new wastewater treatment facility will be on-line, many homes that are presently using septic systems will be connected to the town sewer system. Many of these homes were constructed along the shoreline or close to the Hampton-Seabrook Estuary and are probable sources of bacterial and nutrient contamination.

The goal of this study is to determine if on-site sewage disposal systems are impacting adjacent surface waters of the Hampton Seabrook Estuary. Our findings will have important implications for the State of New Hampshire and for the general public. First, closure of shellfish beds from bacterial contamination represents a direct loss of revenue to the state, $135,000 - $185,000 annually, in lost shellfish licenses (NHFGD, 1991). In addition, it is estimated that shellfishing activities contribute over $3 million into the local and state economy (NHEP, 1995).

NH residents are substantially impacted since contamination of shellfish beds and overlying waters presents a health hazard and lost recreational resource. The results of this study may help the state to develop legislation to better protect our surface waters from pollution so that coastal resources will be safer and more available. In addition, this study will increase our overall understanding of the effects of on-site sewage disposal on ground and surface waters.

PREVIOUS STUDIES ON BACTERIAL AND NUTRIENT DYNAMICS IN THE SUBSURFACE ENVIRONMENT

Background

Septic systems have been used in the U.S. as a means of domestic wastewater disposal since the late 1800's (Canter & Knox, 1985). Over one hundred years later, nearly 26 million on-site sewage disposal systems (OSDS) exist in the U.S. with an increase of over 3 million units since 1980 (Small Flows, 1996). Septic systems and cesspools contribute the largest volume of wastewater discharged directly to soils overlying groundwater and are the most frequently reported sources of contamination(USEPA, 1977). It is estimated that the yearly load of wastewater to groundwaters from OSDS's is approximately 1 trillion gallons (USEPA, 1986).

Septic systems have become commonplace in rural and subrural areas where they are an economic alternative to conventional wastewater treatment facilities. On-site sewage disposal systems are actually recommended for current and future development in many coastal areas because of the high cost of central sewage systems and reduced availability of construction funds (USEPA, 1984, as cited by Cogger et al.,1988).

While conventional wastewater treatment facilities are subjected to strict treatment standards, septic systems are subject to little or no monitoring once they are installed. When designed, sited, and maintained properly, on-site sewage disposal systems can treat wastewater efficiently for many years with little or no environmental impact. In many cases, especially in coastal areas, septic systems have been installed in areas where seasonally or continuously high water tables and soils poorly suited to assimilate wastes are prevalent. Under these conditions inadequate treatment of wastewater disposed of in the subsurface can occur with subsequent impact on ground and surface waters.

Septic System Design & Function

Conventional on-site sewage disposal systems consists of two major components: a septic tank and a soil adsorption system or effluent disposal area (EDA). The primary function of the septic tank includes the storage of liquids, solids, and floatable materials, the separation of solids and liquids, and an environment for the anaerobic decomposition of both stored solids and non-settleable materials (Canter and Knox, 1985, p.49).

Wilhelm et al. (1994) described the most important microbial mediated reactions that occur in the septic tank which influence the effluent composition, these include:

Organic molecule hydrolysis:

Proteins + H_2O --> Amino acids
Carbohydrates + H_2O --> Simple sugars
Fats + H_2O --> Fatty acids and glycerol

Fermentation:

Amino acids, simple sugars --> H_2, acetate(CH3OO-), other acids

Anaerobic oxidation:

Fatty acids + H_2O --> H_2, CH3OO-

Ammonium release:

Urea$[CO(NH_3^+)_2] + H_2O$ --> $2\ NH_4^+ + CO_2$

Amino acids + H_2O --> NH_4^+ + Organic compounds

Sulfate reduction:

$SO4^- + 2CH_2O + 2H^+$ --> $H_2S + 2CO_2 + 2H_2O$

Methanogenesis:

$CH3OO^-$ (acetate) + H^+ --> $CH_4 + CO_2$ $\qquad$ $CO_2 + 4\ H_2$ --> $CH_4 + 2\ H_2O$

The average wastewater load to a septic system is approximately 45 gal/person/day. Septic tank wastewater influent typically contains 0.2-0.6 g/L of organic carbon and nitrogen which account for most of the oxygen demand of the waste water (Tchobanoglous et al., 1991). The anaerobic digestion within the septic tank results in a reduction of sludge volume (40%), biological oxygen demand (BOD) (60%), suspended solids (70%) and conversion of much of the organic nitrogen to ammonium (Reneau et al., 1989). In addition, most of the organic phosphorus is converted to orthophosphate which comprises as much as 85% of the total phosphorus in the effluent (Reneau and Pettry, 1976). Typical values of nutrient and microbial levels reported in septic tank effluent are presented in Table 1.

The primary function of the effluent disposal area or soil adsorption system is to purify septic tank effluent through biological, chemical, and physical treatment. Effluent treatment in the soil adsoprtion system or EDA is critically dependent on a zone of unsaturated soil above the water table. The unsaturated zone increases the contact between effluent and soil particles, reduces the hydrologic flow, and provides an aerobic environment for effluent oxidation. Under aerobic conditions, the following reactions occur:

Organic matter oxidation:

$CH_2O + O_2$ --> $CO_2 + H_2O$

Nitrification:

$NH_4^+ + 2O_2$ -->$NO_3^- + 2H^+ + H_2O$

Below the saturated zone at the top of the water table, another anaerobic zone may be present, depending on the availability of organic compounds, the oxidation of which will cause oxidation demand and anaerobic conditions. Under these conditions, the NO_3^- produced by nitrification can be consumed as an electron acceptor, with organic matter as electron donors, according to the following reaction:

Denitrification:

$4NO_3^- + 5CH_2O + 4H^+$ -->$2N_{2\,(gas)} + 5CO_2 + 7H_2O$

Denitrification can also have nitrous oxide, N_2O, as a gaseous byproduct, along with N_2 .Thus, the potentially toxic NO_3^- is consumed by microorganisms that produce benign, gaseous byproducts that are released harmlessly into the atmosphere.

<u>Potential Pollutants</u>

The concentration of nitrogen in septic tank effluent ranges from 40-80 mg/L N with 25% as urea and 75% as ammonium (Brown et al., 1984; Laak, 1974; Magdoff et al., 1974b). The concentration of phosphorus in septic tank effluent ranges from 11-31 mg/L (Bicki et al., 1984).

The septic tank effluent constituents which are of primary concern from an environmental standpoint include nitrogen, phosphorus, and bacterial and viral pathogens. Nitrogen in the form of nitrate (NO_3^-) may cause methemoglobinemia in small infants and has an EPA maximum permissible drinking water concentration of 10 mg/L as NO_3^-. Nitrogen and phosphorus loading are also of concern since they may lead to eutrophication in waters where their concentrations are limited. Pathogenic bacteria and viruses are always a concern from a public health standpoint since they are often the cause of waterborne diseases.

Nitrogen Transport

Brooks and Cech (1979) conducted a study in rural East Texas to evaluate anthropogenic (nitrogen fertilizer on cropland, animal livestock, and septic systems) and natural (nitrate-rich geologic material) sources of nitrate in well water. Fifty three wells were sampled for nitrate across Houston County which has a population of 18,000 (38% use cesspools and septic tanks) and area of 1200 sq. miles. A subset of 23 wells were sampled for fecal coliforms and fecal streptococci to obtain further information about sources of nitrate, whether by domestic sewage or animal waste, based on their ratios. They found that natural geologic materials (background levels) were not responsible for high levels of nitrate observed in wells. It was determined that animal and more importantly, human sources (septic systems), were responsible for elevated nitrate levels in well water.

Brown et al. (1984), in a 2 year study, assessed the movement of N species below simulated septic lines through three soils; a Lakeland sandy loam (Typic Quartzipsamments); a Norwood sandy clay (Typic Udifluvents); and a Miller clay (Vertic Haplustolls) enclosed in undisturbed lysimeters. A series of suction cup lysimeters were placed 120cm directly below and parallel with the septic line to sample leachate. At the end of the study the soil below and adjacent to the septic line was sampled on a grid pattern for total N and NH_4^+-N. After 16 months of effluent application ammonium saturation of the cation exchange sites in the sandy loam resulted in downward movement of NH_4^+-N in the leachate water with concentrations 10 times greater than background. Downward movement of NH_4^+-N in the soil profile was 100 cm/yr for the Lakeland sandy loam, and 25 cm/yr in the Norwood sandy clay and Miller clay soils. Concentration of NO_3^--N in the sandy loam leachate exceeded 10 mg/l during the first summer when the soil was well aerated but declined well below 5 mg/L with time as the soil became saturated from effluent application (81.8 L/m2 bottom area per day). Conversion of ammonium to nitrate at the wetting front was common during dry periods when the soil was well aerated.

Phosphorus Transport

Hill and Sawhney (1981) constructed an isolated soil block (deep, moderately well drained fine sandy loam, associated with the Ludlow series) encased in concrete down into the underlying bedrock to assess the movement of P under aerobic and anaerobic conditions. Two or three times a week under both aerobic and anaerobic conditions, 565L of wastewater with a P content of 12mg/L was added to soil block over a 2.5 year period. Effluent samples were collected at 45 and 70 cm depths through weep holes and analyzed for P content. Results showed that P moved to ground water before all adsorption sites in the soil matrix were occupied, most probably along preferred pathways. Sorption sites decreased over the 2.5 year study but were never completely saturated, in addition,resting periods allowed for regeneration of adsorption sites and increased the soils ability to adsorb P. Under anaerobic conditions it was found that P sorption decreased and that desorption was also possible resulting in increased P movement.

Jones and Lee (1979) investigated the potential of a lakeshore septic system to transport phosphorus to nearby surface waters during a 4 year study. The system served a middle-aged couple who resided on the property for 9 months out of the year and was located on glacial drift outwash consisting of stratified sandy soil deposits.Despite effluent plume migration to wells as close as 15m downgradient as evident by detection of conservative tracers such as Cl- there was no detection of P in the migrating effluent plume during the entire study.

Transport To Surface Water

Lapointe et al. (1990) investigated the effects of on-site sewage disposal on groundwaters and nearshore surface waters in the Florida Keys. Groundwater samples were collected from wells adjacent to and midway between septic systems and nearby canals, from wells located on a wildlife refuge (control), and from the surface waters of canals. Samples were collected monthly during 1987 and analyzed for dissolved inorganic nitrogen, soluble reactive phosphorus, temperature and salinity. Significant enrichment of groundwater adjacent to on-site sewage disposal systems occurred with DIN enriched an average of 400-fold and phosphorus 70-fold compared to control groundwater samples. Nitrogen to phosphorus ratios of > 100 were typical in enriched groundwaters and increased with distance from OSDS as P was increasingly attenuated. Nutrient concentrations in groundwater were greatest in the winter, were approximately two times greater than summer, with ammonium being the dominant nitrogen form. Seasonal couplings between on-site sewage disposal systems and surface waters were greatest during summer when mixing of seawater with freshwater from ODSD was maximum due to seasonally high tides. The summer wet season also contributed to lateral flow of groundwater nutrients from OSDS by increasing the hydraulic gradient in the direction of surface waters.

Morrill and Toler (1975) conducted a study on the impact of unsewered subdivisions on surface waters in 17 small drainage basins in several Boston suburbs. The basins were characterized by: housing densities which ranged from 0-900 units/mile^2; underlying glacial till consisting of an impermeable mix of sand and silt over bedrock; a shallow water table; and one fifth of the area subject to seasonal flooding. Specific conductance measurements were used to assess the impacts of septic systems on streams draining the basins. Chloride (Cl^-) was also measured and used to correct for the effects of highway salting. The authors found that most of the dissolved solids from septic systems reached the streams. In addition, they determined that the dissolved solids in the base flow of streams is dependent on housing density with an expected increase of 10-15 mg/L of dissolved solids per 100 houses per sq. mile.

In a study of 17 lakeshore septic systems in New York state, Chen (1988) found significant nutrient and fecal coliform pollution occurring in adjacent ground waters. Ratios of individual pollutants in sample and control wells were used to evaluate the degree of contamination of the groundwater. Fecal coliforms, nitrate and phosphate in excess of 9,000 MPN/100ml, 3.7mg/L, and 0.80mg/L, respectively, were observed in wells 2m from the point of discharge. Evidence of fecal coliform and orthophosphate transport over long distances (10-30m) was observed in several wells.

Microbial Transport

Numerous studies have focused on the fate of bacterial contaminants from subsurface sewage disposal/septic systems (Postma et al., 1992; Reneau et al., 1989; Chen, 1988; Cogger et al., 1988; Duda and Cromartie, 1982; Stewart and Reneau, 1981; Brown et al., 1979; Reneau and Pettry, 1975). Removal or reduction of bacterial contaminants in soils occurs by filtration, adsorption, sedimentation and die-off (Reneau et al., 1989). Reneau and Pettry (1975) found significant vertical and horizontal attenuation of fecal coliforms (FC) from septic systems discharging ~10^7/ml FC in three different coastal soils. However, Chen (1988) found FC as far as 34 m from the edge of septic systems near lakes in upper state New York. Stewart and Reneau (1981) found horizontal/lateral transport of FC was greatest when the water table was at or near to the bottom of the drainage area for septic systems. Cogger et al., (1988) confirmed this observation and noted that conditions with high water tables were more anaerobic. Drains and ditches, which are also common in the Seabrook shoreline area, are significant conduits for FCs from groundwater to estuarine surface waters (Duda and Cromartie, 1982). Brown et al. (1979) saw little movement of FC in undisturbed soils, and found FC decreased but survived at least 19 days after subsurface sewage application ended. Reneau et al. (1989) reported expected significant reductions in bacterial contamination within 2-3 months, although enteric bacteria can survive for up to five years, especially in cool, moist environments.

Many studies report movement of bacterial contaminants from septic systems in the range of 10-15 m (Reneau et al., 1989; Duda and Cromartie, 1982), which are distances typical for septic systems from surface waters for this study. Reneau et al. (1989) also cite a vertical distance of ~1 meter is needed for attenuation of bacteria, which is much greater than observed for seasonal high water tables at most of the proposed study sites. Thus, detection of bacteria in all groundwater wells and adjacent surface waters is expected. Postma et al. (1992) conducted a study where subsurface bacterial contaminants were measured before and after occupation of shoreline houses and use of their septic systems, which essentially opposite of the intended study's design. They detected bacteria 6 m from septic systems in Rhode Island within 2 weeks after occupation. They found *Clostridium perfringens* consistently at further distances from the septic system, illustrating the usefulness of this extra indicator for tracing contamination. They also used nitrate as a conservative tracer and evidence of the contaminant plume, much as what was used in this study.

The connection between septic tank sources of contaminants and surface water quality has also been made in numerous studies (Paul et al., 1995; Reneau et al., 1989; Duda and Cromartie, 1982). There is a close relationship between concentrations of bacteria in surface waters and the density of unsewered residences with septic systems (Duda and Cromartie, 1982). They attributed variations in this relationship to changes in ambient soil, tidal and meteorological conditions. Cogger and Carlile (1984) found the greatest lateral movement of FC from septic systems was associated with steep groundwater gradients, as well as previously mentioned high water table. In a very recent study, Paul et al. (1995) found evidence of transport of FC, enterococci and *C. perfringens* through a shallow coastal aquifer from a sewage injection well to on-shore and near-shore wells as far as 1.8 miles off shore. Thus, we may expect to see flushing of bacteria from the subsurface environment into surface waters at great distances, depending on local groundwater flow.

The fate of the targeted bacteria once released into the different estuarine environments have also been studied. *Escherichia coli* and *Enterococcus faecalis* were capable of surviving in soils for at least 32 days, and traveled up to 15 meters in that time (Hagedorn et al., 1978). *C. perfringens* is relatively non-responsive to environmental conditions, as it forms spores and exhibits little or no death in at least 85 days (Davies et al., 1995). They also found that it is unaffected by predators in sediments, whereas FC and enterococci were susceptible to predation, as also found by Gonzalez et al. (1992). The latter two indicators could also grow under favorable conditions in sediments, where *C. perfringens* showed no evidence of growth. In Massachusetts, studies revealed that indicator bacteria may multiply in sediments enriched with nutrients from POTWs, persist in beach wrack on shorelines, and be resuspended from sediment sinks to give elevated bacterial levels in water that do not accurately reflect contaminant loading (USEPA, 1991). Thus, we may expect all three indicators to persist in the study areas, with FC and enterococci capable of regrowth or re-entry into a culturable state.

Once the bacteria enter the water column, they may be more susceptible to environmental conditions. Solar radiation has been shown to be a major factor in the die-off of FC (Solic and Krstulovic, 1992). Shiaris et al. (1992) found tidal exposure to be a significant factor associated with disappearance of FC, and probably enterococci, in sediments below a sewage outfall in Massachusetts, probably as a function of solar radiation. Pommepuy et al. (1992) showed that *Salmonella* sp. survived longer in turbid rather than clear marine waters because the suspended particles helped to protect bacterial cells from sunlight. Sorensen (1991) and Gonzalez et al. (1992) showed that predation by eucaryotic microorganisms was a very significant factor controlling bacteria survival in marine waters. Thus, we may expect to see large decreases in bacterial concentrations once they reach Hampton Harbor, which has ~90% of its volume exchanged each tidal cycle, bringing in high salinity and clear water with high tide and exposing sediments and shallow waters to solar radiation at low tide.

SITE SELECTION PROCESS

The process by which study sites were chosen was dominated by the need to find knowledgeable people willing to participate. Attempts were made to find sites with properties characteristic of a range of conditions, and all sites had to be near to surface waters. The perimeters of areas in Seabrook that were close to tidal waters or freshwater tributaries were encircled on a map. This map was given to the Seabrook Health Officer who then contacted people who may be likely candidates in these areas. Seventeen different lots were identified as potential study sites, and thirteen were chosen for study. Two of the sites were assessed only for implementation of the tidal water assessment forms by Elkind Environmental Associates, Inc. (1994), while the remaining eleven sites were assessed for wellwater assessment as well.

The eleven sites chosen for wellwater assessments are identified on Figure 1 as small circles around the dwelling at the study sites, and labeled using a 2-3 capitol letter designation, as described in Table 2. Each owner was interviewed in person and given time to consider participating before signing an access agreement form.

SOILS AND SITE CHARACTERISTICS

The selected sites were located in two general areas: on River St. bordering Hampton Harbor and marshes, and in town at various locations. All selected sites were subject to a thorough assessment that included Order One soils surveys, location and description of septic system/effluent disposal area, and other important site characteristics (Elkind Environmental Assoc., 1994). This preliminary study provided extremely useful information for the ensuing wellwater assessment studies. Generally, the soils are glacial outwash sands and gravels that cover bedrock that is near the surface in many areas. The areas near tidal waters have an organic surface layer overlying sands and gravels. Sites in town are generally on natural soils (except the Walton Rd. site) while the River St. sites are built on filled wetlands/tidal marshes. The soils and characteristics of selected study sites are summarized in Table 3, with a more detailed description of on-site soil properties in Table 4.

Most of the sites had effluent disposal areas (EDAs) located on filled or excavated soils (100A, 299A, 300A), which are not formally classified for soil suitability. However, soils at all sites have severe limitations for septic systems (groundwater contamination) because of the prevalence of sandy soils, which are poor filters for septic system effluent, and the potential for ponding at poorly drained sites (Tables 3 and 4). One site was adjacent to a freshwater marsh, six sites were adjacent to salt marshes, and three sites were adjacent to a beach area. Many of the septic systems were simply cesspools or were so old that they were not state-approved systems. Only two sites, KDB and RC, had state-approved systems (Table 3). All sites were in relatively close proximity to the adjacent marsh or beach.

SEABROOK WELL INSTALLATIONS AND HYDROLOGY

Procedures

Installation of Small Diameter Monitoring Wells

Sixteen small diameter stainless steel wells were installed as part of the investigative program for the period 1995-1996. Seven of those wells were installed at the interface zone between four respective sites and the marsh/bay. The remaining nine wells were installed at the edge of the waterway channel immediately down-gradient of the respective sites. The purpose of these wells was to provide sampling points at potential local groundwater discharge zones for the groundwater flowing beneath the respective site EDAs. The sampling program from these new wells was designed to look for nutrient and bacterial transport from the EDA directly into the marsh waters, or in one case, the bay. The wells were made from stainless steel, since it was suspected the black iron pipe used for the original wells was susceptible to corrosion. The saline water of the tidal marsh areas would be more corrosive to the well pipes than the freshwater areas. Corrosion can have the effect of closing off the well screen openings or "slots".

Each well consisted of 1/2-in nominal diameter 304 stainless steel pipe. The pipe came in 10-ft sections. The well sections had a 0.5-foot section of blank pipe at the well bottom to act as sump for soil particles. Above the sump was a one-foot length of screen, which consisted of four rows of two-inch long slots, 0.01 in. wide, cut into opposite sides of the pipe with a laser. The slots were positioned 1/4-inch apart along the one -foot length and aligned such that the gaps were offset between the two rows to maintain strength. The remaining length of the 10-ft pipe was blank riser. Prior to installation, a stainless steel drive point was inserted into the sump end of the well, held in place by a rubber o-ring. No wells were installed of length greater than 10 ft.

The wells were installed using a slide hammer. The well was positioned using a 10-ft step ladder, and the slide hammer was slid over the well. The well was driven using a lift and drop action of the slide hammer. The well was installed so the screen was at or less than 3 ft below the water table. The water level was checked using an electric sounder. The wells were developed using a 1/2-in. OD. polyethylene tube with a Delrin check valve on the bottom to create an inertial bailer. Once developed the wells were allowed to come to equilibrium, and the depth to water was checked to make sure the well was installed to a sufficient depth. The wells were finished by inserting a plastic cap. No wells were flush mounted during this phase of the installation.

Wells were installed at four sites. A summary of the installation statistics is presented in Table 5. Two wells were installed in the tidal channel at the Eastman Home site on River Street. No site/marsh interface wells were installed here, as two of the existing wells already serve that purpose, REH-2 and 3. The new wells were designated REH-7C and 8C. Their locations are shown in Figure 2. In addition, the original carbon steel well at REH-3 was pulled out for hydraulic testing of corrosion in the lab , and replaced with a stainless steel well. This new well is designated as REH-3SS in Table 5. The installation was made 3/14/96, so water levels after this date refer to REH-3SS.

Five wells were installed behind the Pike and Camacho sites. Three of the wells were installed in the edge of the low-tide bay. Two of those wells were within one foot of each other, at different heights. The purpose here was to measure the vertical hydraulic gradient. The third well in the bay was installed along an extension of the border of the Camacho and Pike sites. The fourth well was installed on the bank during low tide, down-gradient of the Hopkinson and Pike sites. These wells, shown on Figure 3, were designated RP-6B, 7B, 8B, and 9B respectively.

The third site with marsh and channel wells installed was the Hubert site on Walton Road. The locations are shown in Figure 4. Two wells were placed at the backyard/marsh interface down-gradient of the EDA and existing wells, and two wells were installed at a distance in the nearest channel to the site. These wells were also located in a down-gradient direction from the EDA. The designations of the two marsh wells was WRH-7M and 8M, and the two channel wells were labeled WRH-9C and 10C.

The final site was the Bakutus site on Kimberly Drive. Six wells were installed in a radial pattern from the two EDAs. Two of those wells were installed in separate tidal channels, respectively. The other four were installed at the interface of the site and the marsh, or in some cases, just back from the interface. This site presented the difficulty of having wells installed which were dry. Several wells were relocated in order to be able to obtain a water sample. The marsh interface wells shown on Figure 5 were denoted KDB-10M, 11M, 12M, and 15M. The two channel wells are designated KDB-13M and 14M. Note that only channel well KDB-14C was able to be shown on Figure 5.

Results

Tidal Influence of Water Levels and Groundwater Flow

The study performed during the period 1994-1995 identified where groundwater flow directions at sites close to the tidal marsh (or the bay) were significantly different in the summer of 1995 from the spring of the same year. An example can be seen in Figures 6 and 7. Figure 6 shows the groundwater directions at the River Street Eastman Home site for measurement taken on March 13, 1995 at low tide. Figure 7 shows the groundwater flow directions estimated from measurements taken on May 31, 1995 during high tide. Similar fluctuations in groundwater flow directions were noted from the groundwater level data obtained during the regular sampling program at other River Street sites. These sites included the Hopkinson, Pike, and Eastman Trailer properties. A slight shift in groundwater direction was also noted at the Hubert site and, to a lesser degree, at the Locke site.

In order to obtain a better understanding of the tidal influence on groundwater flow at each of these sites, a long term monitoring program was instituted. This program was instituted by installing pressure transducers in wells which were used to identify groundwater flow directions. The transducers were connected either to a lap-top computer, or CR-10 data loggers. In either case, the groundwater levels were measured on 10 minute time intervals over a period of several days. In this way, the variations in the depth of water above each of the undisturbed transducers would be monitored for at least four or five tidal cycles. The monitoring was typically done during periods including, or close to, a full or a new moon to take advantage of the larger tidal fluctuations. Long term monitoring was performed on River Street at the Eastman Home site, and also at the combined sites of Hopkinson, Pike, and Beckman. Separate long-term monitoring was performed at the Hubert site on Walton Road, and at the Bakutus site on Kimberly drive.

The results of the long-term monitoring at the Eastman Home site are shown in Figure 8. One transducer at this site was placed in the tidal channel at a point closest to the home EDA. Five other transducers were placed in all the site wells except the deep well. The long term monitoring lasted for 4.9 days. The groundwater flow directions for the high tide periods are shown in Figure 9. In this case the groundwater flow is toward the EDA and REH-1 from the marsh channels.

Figure 8 shows that there is a threshold for some of the wells; when tidal levels are below the threshold value, these wells show no reaction or influence. This can be seen in the early time plots for wells REH-1, REH-2, REH-4, and REH-5. Well REH-3 shows a consistent tidal influence. The levels for Well REH-4, located in-between the EDA and the grey-water outlet, shows indication of tidal influence at higher tides, but also reflects dosing of the EDA. This conclusion is drawn since the reaction of the well at 2250 minutes is not repeated for the tides at 3800 minutes or 4500 minutes, even though those tide levels were higher than the high tide level at 2250 minutes. Well REH-1, the upgradient well, shows a similar reaction. When the high tide level becomes greater than elevation 97 feet, all the wells on site experience a change in piezometric level. It should be noted that at the highest tides, the groundwater flow directions completely reverse, with the flow going from the tidal channel towards the upgradient well, REH-1. An example of this behavior is shown in Figure 10, for the elevations at 0641 11/22/95. The steepest gradient is from the direction of well REH-2 to REH-1. This site, therefore, experiences a series of backwash effects roughly twice a month due to the tides. Furthermore, looking back at Figure 9 for the March 13, 1995 water levels, it may be concluded that this plot must be for a time when the tide level is below the reaction threshold of some of the wells, since the flow direction is not towards the EDA.

Further down River Street, at the combined sites of Hopkinson, Pike, and Beckman, the tidal influences can be seen in four of the wells monitored, shown in Figure 11. This site was monitored in June, 1996, just before a new moon. Five transducers were connected to two

Campbell Scientific CR-10 data loggers that were time synchronized. The transducers were placed in key wells for determining the groundwater flow directions in the vicinity of the four adjacent sites (Hopkinson, Pike, Camacho, and Beckman). These included an upgradient well, RB-3, and two down-gradient wells, RH-4 and RP-3. RH-2 and RP-2 represented intermediate wells. The largest fluctuations were seen in well RH-4, closest to the bay. The two wells monitored on the Pike site did not show significant tidal influences, although there were some asynchronous fluctuations with the tides. The highest peak shown for well RH-4 corresponded to a new moon, therefore any threshold effects should have been seen, consequently it is concluded the wells on the Pike site are not significantly influenced by the tides. There was no indication of the wells near the Beckman house having any tidal reaction. In fact, the upgradient well showed evidence of a very gentle groundwater level decline. Well RH-2 showed a more pronounced asynchronous reaction to the tides than the Pike site wells, even though RH-2 is close to the same distance from the bay as well RP-2. The fact that a more pronounced reaction was seen is indicative of an area of higher hydraulic conductivity. This conclusion is also consistent with the hypothesis drawn by examining the groundwater flow directions. The implications of Figure 11 are that there is a backwashing effect going on at the Hopkinson site depending on the tides. There was no indication of threshold tidal depths as seen for some of the Eastman home wells.

The third site monitored was the Hubert site. This site was chosen because the monitoring well groundwater level data suggested a distinct groundwater shift in the flow directions between the spring 1995 and summer 1995 water level data as indicated by Figures 12 and 13. The site was instrumented in November 10, 1995 with three pressure transducers. This was three days after the full moon. The wells instrumented created a triangle from which the flow directions could be discerned. These included two up-gradient wells, WRH-1 and WRH-2, and the farthest down-gradient well, WRH-6. The monitoring results are shown in Figure 14. This figure shows a reaction in all wells due to a rainfall event, but there is no evidence of any tidal influence in any of the wells. It may well be that the shift seen between Figures 12 and 13 are due to measured effects of dosing of the EDA at the time of measurement. There are no records of when the residents use their system. The fluctuations of the upgradient wells indicates that the relative piezometric heights changes during such events, which would be sufficient to cause the shift in groundwater directions seen between Figures 12 and 13. The shift, therefore, is not caused by tidal influences.

The last site instrumented for long term monitoring was the Bakutus site on Kimberly Drive. This site has two adjacent EDAs, and was instrumented with five pressure transducers in wells that were key to estimating groundwater directions. The wells in which transducers were installed include: up-gradient well KDB-1; a well through the EDA, KDB-4; a well lateral to the EDA, KDB-6; and two down-gradient wells, KDB-5 and KDB-8. The transducers were hooked up to a Campbell Scientific CR-10 data logger on March 25, and logged for two days. The logging occurred during the first quarter of the moon. The time record of the height of groundwater above the transducers is shown in Figure 15. There were no indications of any regular tidal fluctuations. The only significant fluctuation was in well KDB-4, which is through the EDA. The well recorded a diurnal pattern, which is believed to reflect the household septic usage. Groundwater levels in KDB-4 increase in early evening hours, and decrease during the morning hours. This pattern did not appear to affect any of the other wells monitored, wells KDB-6 and KDB-8 being the closest. There was no indication that anything other than a local direction alteration would occur around the wells in the EDAs.

Hydraulic Conductivity Testing of Seabrook Wells

Slug tests provide a means of evaluating the hydraulic conductivity of a formation in the immediate vicinity of the well. The tests are performed by creating an instantaneous deflection in the water level in the well bore, and monitoring the aquifer response as the water recovers to its original static level.

Slug tests were performed in the majority of the microwells installed at Seabrook in the winter of 1995 and spring of 1996. All tests were performed using pressure transducers and lap-top computers to monitor the piezometric response in the microwells during the test. The response times were measured in terms of seconds; typical response durations were 15-30 seconds, but some wells had a response duration up to 10 minutes

The values of hydraulic conductivity obtained from these tests are point values representing the aquifer properties in the near vicinity of each well. In formations with high values of hydraulic conductivity, the inertial effects of the aquifer can be significant, causing oscillatory responses of the piezometric level in the well. This phenomenon was not observed in the shallow wells at Seabrook.

Procedure

The slug testing program was performed by using a mechanical slug to do a falling head slug test on the microwells. The mechanical slug tests were performed by attaching a metal bar to the end of a Druck PDCR-35/D miniature submersible pressure transducer by a fine brass wire, and essentially dropping the transducer and slug into the well to a pre-determined depth below the water table. The metal rod displaced the water in the well bore, instantaneously raising the level. The subsequent recovery of the water level in the well bore to the static level was monitored at regular intervals with the pressure transducer and a lap-top computer. This test was called a falling head slug test. The data were reduced according to the Hvorslev Method (Hvorslev, 1951) to estimate the hydraulic conductivity in the vicinity of the well. Normally a falling head test is coupled with a rising head test in the same well, and the resulting two values of hydraulic conductivity are averaged. The small diameter of the microwells precluded removal of the slug past the pressure transducer, so a rising head slug test could not be performed. The hydraulic conductivity results for the mechanical slug tests represent values only for falling head slug tests.

In several wells, the slugs had difficulty passing through the well bore to the water surface. In such instances, a metal rod of smaller diameter was tried. If still unsuccessful, a rod of shorter length was used. The metal rods that were used for most of the tests were 3 ft. long and either 7/16 inch or 3/8 inch diameter galvanized steel. There were a few wells that required the use of a 2 ft long rod, and in several instances, the well would only allow a 1 ft 7/16-in diameter rod to pass. More frequently, there was insufficient water in the well to use the larger length slugs, and the 12-inch slug was used. This was commonly the case at the Bakutus site. The 7/16 inch rods theoretically produce a 0.77-ft rise in the water level of the well per foot of rod submerged. Similarly, the 3/8 inch rods produce a 0.56-ft rise in the water level per foot of submerged rod. The response of the aquifer was so rapid, however, that the full theoretical displacement depth was rarely measured.

There were two sites where wells have been bent and straightened enough for sampling, but even a one foot slug would not pass. These sites included the Beckman site and the Eastman Trailer site (RET), both on River Street. While not every well was bent at the Eastman Trailer site, access proved to be a problem during the testing program, and consequently this site was not tested. All the wells on the Beckman site refused passage of the 1-foot slug.

The pressure transducers were directly connected to an analog-to-digital signal converter by Remote Measurement Systems, which in turn was coupled to a lap-top computer. Software written in Basic queried the A/D converter at a rate of 8 to 9 times per second for pressure readings. The majority of the slug tests performed had a duration of 10 seconds or less. The software converted pressure readings to feet of water above the transducer. The recorded height of the water displacement was in part a function of the speed at which the slug could be dropped to a stable position.

Pressure slug tests have been devised to test wells in which the mechanical slug would not pass down to the water surface. In this case a large tee fitting was connected to the well through which the cable of the pressure transducer passed. Rubber o-rings provided a seal around the cable at a fitting on the top branch of the tee. An air source was connected to a fitting at the side branch of the tee. The assembly was connected to microwells having an above ground completion (stick-up) by force-fitting a 0.75-inch vinyl tubing over the 0.620-inch microwell pipe and securing it with a radiator clamp. The tubing was connected to the remaining branch of the tee. All connections had to be air-tight.

The test is performed by applying a known air pressure to the well, and monitoring the response with the pressure transducer. Once the level in the well had stabilized, the pressure was suddenly released. The application of pressure depressed the water level in the well below the piezometric level of the formation. Releasing the pressure rapidly was similar to the removal of a mechanical slug or volume of water. The same procedure can be used with a vacuum to raise the water level in the well. Once released, the decline in the water level was similar to the falling head test of the mechanical slug test.

The pressure slug tests could only be performed in those wells in which the well screen was completed below the water table. Wells that were screened across the water table are incapable of holding either a pressure or a vacuum. In the case of the Seabrook wells, all the shallow wells are screened across the water table, and consequently will not hold pressure. Many of the deep wells have a joint between well sections where blank pipe was added to the original 10 or 11 ft well. This joint was typically above the water table, and was not air tight. Consequently, the deep wells were only tested using a falling head mechanical slug test.

Analysis

The test data was analyzed according the Hvorslev method. The height of the water column above the transducer was normalized with respect to the maximum observed deflection, and the normalized drawdown was plotted on a log scale of a semi-log plot for the respective elapsed time value on the arithmetic scale. An example plot of a slug test on well RH-4 is shown in Figure 16. The time value (T0) when the straight-line data plot had a normalized drawdown value of 0.37 is used in the following equation to compute the hydraulic conductivity:

$$K = \frac{r^2 \ln(L/R)}{2LT_o} \qquad (1)$$

where:

r	=	radius of well screen in ft,
R	=	radius of the well bore in ft,
L	=	length of well screen in ft,
T0	=	Intercept time in seconds.

A few of the wells test data were analyzed using the computer software program ADEPT (Mathsoft, Inc., 1994) which plotted the data, and fit a straight line to the plot for the Hvorslev method. The program determined the intercept of the fitted line with the drawdown value of 0.37, and provided a calculated hydraulic conductivity. The majority of the test data was analyzed using a spread sheet and data plots.

Results

A summary of the results of all the wells tested in the slug test program at Seabrook is presented in Table 6. Conditions which prevented the test from successful completion or analysis are noted in the comment column. The table provides the geometric mean of hydraulic conductivity of all the tests performed on a well in terms of both ft/day and cm/s. In all, 145 successful tests were analyzed. The results for all the sites were very similar, all in the 1×10^{-6} to 5×10^{-4} cm/s range. The only exception was REH-1 on the Eastman Home site, which had a mean of 5.4×10^{-3} cm/s. This well represented a local zone of high conductivity. Nearby, the well couplet REH-4 and REH-6 had a slightly lower conductivity. The wells that were closer to the channel had hydraulic conductivities that were an order of magnitude less than REH-4. This is supported by the piezometric contours shown in Figure 10, where there is greater distance between the piezometric contours in the vicinity of wells REH-1 and 4, and the contour lines become closer together toward the channel indicating more resistance to flow, evidenced by the reduced hydraulic conductivities.

Both the Locke and Hubert sites had consistent results of the hydraulic conductivity testing. Values hovered in the range of 11×10^{-5} to 7.8×10^{-5} cm/s for the Locke site, and 1×10^{-5} to 4.3×10^{-4} cm/s at the Hubert site. On site, the well through the Hubert EDA had the highest hydraulic conductivity, with 1.4×10^{-4} cm/s. The soils in the marsh channel behind the Hubert home have similar hydraulic conductivities, on the order of 2.8 to 4.3×10^{-4} cm/s. The deep well had a hydraulic conductivity similar to the other site wells, showing no change in conductivity with depth.

On the combined River Street sites, including the Pike, Hopkinson, and Camacho sites, the hydraulic conductivities were consistent, in the 1 to 4.8×10^{-5} cm/s range. Two exceptions should be noted. Well RP-2 has a lower value for hydraulic conductivity, on the order of 4.7×10^{-6} cm/s. This well is close to River Street, and is also in the area at which the groundwater contours start bending around in Figure 17. The wells closest to River Street on the Hopkinson site, RH-1 and 2, have hydraulic conductivities an order of magnitude higher, suggesting there may be a less conductive zone or "barrier" between the Camacho and Pike houses. This is also supported by the piezometric data. None of the bay wells were tested.

Testing at the Bakutus site on Kimberly Drive was difficult, due to the limited water column in many of the wells. A one-foot slug was used for most of the testing. In some cases, this was dictated by what would pass down the well. Three wells had marginal water columns in the well for testing, KDB-4, 7, and 8. No successful tests were able to be done on the last two wells. In addition, well KDB-11 provided insufficient response to analyze. The wells that were successfully tested were in the same range as other sites. One of the wells successfully tested along the site/marsh interface had the highest hydraulic conductivity, 2×10^{-3} cm/s. The next highest zone of conductivity was in the vicinity of KDB-2, upgradient near the home. The southern house site and EDA had slightly less permeable soils, witnessed by KDB-1 at 6.6×10^{-6} cm/s, and KDB-3 at 8.9×10^{-5} cm/s. Down-gradient, KDB-5 had 1.4×10^{-5} cm/s, in the same range, but lower than the northern portion of the site. The other wells slightly higher hydraulic conductivities.

The Cronin site on Forest Drive was slightly less conductive than most other sites. The highest hydraulic conductivity measured on this site was 1.4×10^{-5} cm/s. The other wells had conductivities of approximately 6.5×10^{-5} cm/s.

Groundwater Flow Characteristics

Groundwater flow characteristics of direction and velocity were evaluated from the test data presented above. In order to estimate the flow velocity, first the groundwater piezometric contours were drawn on a map of the site. The hydraulic gradient was measured from the piezometric contours in the primary directions of flow. The measured gradients were multiplied by the hydraulic conductivity for the area where the gradient was measured. The resulting value represents the estimated groundwater flow velocity. A summary of the groundwater elevation data collected to date is presented in Table 7. The hydraulic conductivity values were taken from the slug testing results in Table 6.

The June 6, 1996 groundwater contours for the River Street sites including Beckman, Hopkinson, Pike, and Camacho are shown in Figure 17. Groundwater flow is generally from the marsh to the bay. There is a flattening out of the contours in the area between the Hopkinson and Pike homes. This bending could be a result of an area of low hydraulic conductivity. The hydraulic conductivities of Table 6 show the conductivity is lowest at RP-2. This tidal influence will change these contours slightly, making the flow bend less during periods of low tide. The flow directions from the Hopkinson septic system are directly toward the bay wells, although other data suggest that flow direction changes (see below). Flow from the Pike system appears to be in the direction of the Camacho system. Flow velocities from the Hopkinson system are estimated to be 8.2 x 10^{-7} cm/s (0.0023 ft/day), and from the Beckman site where the gradient is larger, the estimated velocities are 3.4 x 10^{-7} cm/s (0.0010 ft/day).

Typical contours for the Eastman site at high tide are shown in Figure 9. Groundwater flow is in the direction of well REH-4 from the channel. Using the primary flow directions noted in Figure 9, the estimated groundwater velocity is 3.75 x 10^{-7} cm/s (0.0011 ft/day). The groundwater velocity is greater during low tide (Figure 10), when the direction is toward the channel from the septic system. Estimated low tide velocities are 2 x 10^{-7} cm/s (0.059 ft/day). The data from Table 7 indicates that in early 1995, the well couplet (REH-4 and REH-6) indicated an upward vertical gradient. This changed over the course of the year, and since May, 1995, the gradient has been measured as a downward gradient, tending to drive groundwater originating at the site deeper in the subsurface.

The groundwater flow directions for the Hubert site are indicated on Figure 18. These contours are indicative of the groundwater flow direction shown for the June 29, 1995 data in Figure 13. The primary flow direction is from the EDA toward WRH-8M. The estimated groundwater velocity at this site is 2.3 x 10^{-6} cm/s (0.007 ft/day). As noted above in the discussion of the long-term monitoring, the relative piezometric levels changed between WRH-1 and 2, which could skew the primary flow direction towards WRH-7M.

The primary flow direction at the Locke site on Causeway Street is from the EDA to a point just south of well CSL-6, as shown in Figure 19. The estimated velocity is 1.25 x 10^{-6} cm/s (0.0035 ft/day). Long term monitoring was not done on this site, however based on the findings at the Hubert site, no tidal influences would be expected.

The groundwater contours for the Bakutus site on Kimberly Drive for the June 6, 1996 data are depicted in Figure 20. The addition of the marsh wells has refined the direction of groundwater flow from the immediate site. The new wells indicate that the majority of the flow that leaves the site eventually flows toward the northern channel. There is still a component that flows to the east, but it appears that flow initially heading northeast from the EDAs will eventually turn to the north. This may be due to the slightly higher hydraulic conductivities found at the northern well locations. Estimated velocities on this site are 1 x 10^{-6} cm/s (0.0028 ft/day) to the east, and 1.3 x 10^{-6} cm/s (0.00338 ft/day) to the north.

The contours at the Cronin site on Forest Drive are shown in Figure 21. The contours are not well refined with only three wells surrounding the EDA, but it appears the primary direction for June 6, 1996 was to the west from the EDA. The estimated velocity is 1.6 x 10^{-7} cm/s (0.0005 ft/day).

Analysis of the Use of Soil Mottling as the Predictor of Estimated Seasonal High Water Table (ESHWT)

One of the objectives of this project was to compare estimates of ESHWT to the actual high ground water table (HWT) value as measured in wells. The first step was assessing the ESHWT for the existing systems. This was performed and completed by Fred Elkind and Dave Allain and reported in, "Tidal Water Assessment, Implementation of Tidal Water Site Assessment Forms For Selected Seabrook Properties", November 1994. The selected subsurface disposal systems were investigated, in October, 1994, by hand-auguring both upgradient and downgradient of the effluent disposal areas. ESHWT's were interpreted by redoximorphic features (soil mottling) or evidence of wetness (water in the auger hole). All of the ESHWT data was reported as depth (in inches) below ground surface (bgs).

Subsequent to the ESHWT investigation, wells were then installed at these same sites. The installation of wells was initiated in November of 1994 and carried over to 1995. The wells used for this study were steel or stainless steel half-inch diameter (nominal) wells. The screen for these wells was vertically slotted sections of the steel/stainless steel pipe. The laser-cut slots were two inches long by 0.01 inches wide, and two rows of slots on opposite sides of the pipe were cut. The screen lengths varied from 5 to 10 ft. The wells were installed by using a vibratory hammer to drive them into the ground and to the desired final depth. Wells were then developed by using an inertial bailer to purge water until the water appeared relatively free of sediments. An inertial bailer is 3/8 inch polyethylene tubing fitted with a Delrin (TM) foot valve. The bailer is thrust into and out of the well and the foot valve maintains flow out of the tubing at the top of the well. Well water levels were measure with an electrical sounder and referenced to the top of the well. The measurement of the distance of the top of the well to the ground surface then allowed the water level readings to be referenced to the top of the well. The measurement of the distance of the well to the ground surface then allowed the water level readings to be referenced to a depth below ground surface (bgs) reading as were the ESHWT measurements.

Since well water level data was not measured continuously, it cannot be asserted that the absolute high water table (HWT) was measured in 1995 and 1996. However, the readings that were taken can indicate the validity of the use of the ESHWT in that if the ESHWT is a good indicator of HWT, then all measure data should be at or physically lower than the ESHWT. If measured water levels exist higher than the ESHWT, then basing septic system designs on ESWHT may be inappropriate. The data collected for the ESHWT were plotted against the HWT measured for 1995 and 1996, for each system in Figure 22. The following are some interpretations of this data.

Although contrary to the climatology, 1995 data plots appear to have been wetter than 1996. The data shows that the 1995 HWT was closer to the land surface than 1996 HWT. Climatologically, 1995 was a very dry year whereas 1996 had record amounts of snowfall and a wet spring. However, more data was taken in 1995 than 1996 and therefore it is quite likely that the 1996 data set does not represent the actual HWT for that year, rather the water table for the sole day of observations. Generally the HWT for 1995 occurred in the winter (December 1994 to March 1995). For 1996, only June data was taken. Therefore, no conclusion about wetter versus drier year should be made from the measured values of HWT from 1995 or 1996 since water levels were not taken on a scheduled frequency sufficient to clearly delineate HWT. Another complicating factor is that at some sites the water table is affected by the tide.

The line of perfect agreement (solid line) displays how hypothetically the ESHWT would plot against the annual HWT in Figure 22. Since the annual HWT is variable, it is doubtful from the outset that all data would fit on this line. However, if the ESHWT were a conservative predictor of HWT, then all data would plot above the line. Six of the 10 systems studied displayed measured water levels shallower than the ESHWT (data plotted below the line of perfect agreement). Obviously the absolute HWT for these same systems would also plot below this line, and below these data points. This means that the ESHWT is not a conservative predictor of HWT.

The intent of a subsurface disposal system is to provide some treatment of wastewater before it enters ground water. This treatment is to occur in the unsaturated zone below the leach field lines. The more unsaturated zone there is, the more treatment that occurs. It is generally accepted that three feet, or more typically four feet or more, of unsaturated zone should separate the leach field lines and the water table. ESHWT is used in the design of the vertical location of the leachfield lines. If the ESHWT is not conservative in its estimate of the HWT, then less saturated zone exists than presumed during the HWT period of the year, and inadequate septic tank effluent treatment probably occurs. It should be noted that in reality, immediately above the water table is located another zone of saturation known as the capillary fringe. This zone is under negative pressure and is therefore not represented in the well measurements of the HWT. The zone can be on the order of one inch to a little over one foot in the soils suitable for leach field systems. The capillary fringe is usually not included in leach field design considerations and therefore will not be included in the discussion here. However the point being that if a separation distance between HWT and the leach field system is used for design, it must be recognized that this is not the distance of unsaturated soil. The actual value is less than this due to the capillary fringe. This is why a good, conservative estimator of the HWT is needed in the design of septic systems.

As it would be impractical to install monitoring wells and collect data a few years in advance of constructing every leach field, the ESHWT will most likely continue to be a critical design parameter and in light of the data collected for the present study, it is recommended that ESHWT values be reduced by two feet. This recommendation is depicted in the data plot as the line that envelops the mottling data (dashed line). It can be seen that all data of the present study lies above this envelope line. this means that the ESHWT is by itself not an accurate prediction of how high the water table comes every year, however a simple correction to yield a better prediction of the HWT (without wells and well measurements) is to subtract two feet from the reported value of the ESHWT. The resulting modified ESHWT (mESHWT) is better and more conservative predictor of the HWT.

WATER QUALITY AND CONTAMINANTS

Effluent from septic tanks contains high levels of phosphorus, nitrogen and fecal-borne bacteria. The effluent characteristics can vary widely, depending on many variables, and 'typical' contaminant concentrations, based on numerous previous studies, are presented in Table 1. The nitrogen discharged from septic tanks is in the forms of organic nitrogen and ammonium, with no nitrate. Much of the phosphorus is orthophosphate. Thus, detection of nitrate in groundwater is indicative of transformation of the ammonium to nitrate under aerobic (i.e., unsaturated) conditions. The values in Table 1 can serve as a guide for assessing the effectiveness of study systems and potential problem areas.

Procedures

Well Sampling

Wells were sampled for bacterial and nutrient contaminants. During each sampling, the weather and tide were recorded, and it was noted if precipitation had occurred in the last 24 hours. Before sampling the wells, the depth to the water table from the TOC was measured for each well. Depth to water was measured to the nearest hundredth of a foot, using the Slope Indicator Co. water level indicator (Model 51453), and recorded.

The wells were prepared for sampling by inserting bailers (sterile polyethylene tubing 1/2" O. D.), down into the well to the approximate depth of the water table. The bailer was connected to a portable Masterflex peristaltic pump (model H-07570-10) using a sterile HDPE fitting and sterile Masterflex silicone peroxide cured tubing.

Three well volumes were pumped from each well before collection of samples began. As the well was pumped, the water level in the well often fell as indicated by the presence of air bubbles in the bailer tubing. Under these conditions the bailer was inserted deeper into the well, as the water level fell, so that well water was continuously withdrawn. As often happened, the bailer reached the well sump before three well volumes could be collected. When this occurred the bailer was moved vigorously in an up and down fashion to facilitate the removal of any sediments that may have collected at the bottom of the well. Wells in which three well volumes could not be evacuated prior to reaching the sump were considered to be sufficiently evacuated for sampling.

Once three well volumes were evacuated or the sump was reached, the well was allowed to recharge for several minutes before samples were collected. Three 1L Nalgene sampling bottles were filled, one acid-washed bottle for nutrient analysis and two sterile bottles for microbiological analysis. Extreme care was taken to prevent contamination of sample bottles and caps while sampling was taking place. Wells which did not produce sufficient quantities of water to fill all three sample bottles were sampled repeatedly until an adequate amount of sample was obtained to perform analysis. The samples were labeled, stored on ice in a cooler, and transported back to Jackson Estuarine Lab for analysis within six hours of collection. Well samples were analyzed for ammonium, nitrate, phosphate, pH, TSS, % organics, salinity, fecal coliforms, *Escherichia coli*, enterococci, and *Clostridium perfringens*.

Surface Water Sampling

Surface water samples were collected at low tide both up stream and down stream from inland and coastal sites and at various locations throughout the study area (Figure 23). Three 1L Nalgene sampling bottles were filled, one acid-washed bottle for nutrient analysis and two sterile bottles for microbial analysis. Microbial surface water samples were collected manually according to the technique described in Standard Methods for the Examination of Water and Wastewater (Standard Methods, 18th ed., 1992). Ambient water temperature was recorded using a hand held thermometer. Samples were stored on ice in a cooler and transported back to the Jackson Estuarine Laboratory (JEL) for analysis within 6 hours. Surface water samples were analyzed for ammonium, nitrate, phosphate, pH, salinity, fecal coliforms, *E. coli*, enterococci, and *C. perfringens*.

Lysimeter Installation

Soilmoisture Equipment Corp.'s pressure-vacuum soil water samplers (Model 1920) were installed under the EDA's at 5 sites. A hole, approximately 0.5 feet in diameter, was excavated manually with a post-hole digger down through the EDA. The hole was dug until the bottom of the EDA (gravel/soil interface) was reached. A 3-inch diameter hand held soil auger was then used to bore an additional hole, 0.5 -1.0 feet below the bottom of the EDA, in which the lysimeter would be placed.

A small quantity of crushed 200 mesh silica-sand was poured into the 3-inch bore-hole and the lysimeter was inserted. Additional 200 mesh silica-sand was poured into the bore hole so that the sand was at least six inches above the ceramic cup of the soil water sampler. The 3-inch bore hole was back-filled with native soil until the soil level inside the hole was just above the top of soil water sampler.

A 4-inch diameter PVC pipe was inserted down the inside of the 6-inch hole and cut flush with the ground surface so that the sampling tubes could be accessed. Native soil was back-filled around the outside of the PVC pipe up to the ground surface. A small hand held vacuum pump was used to place a vacuum pressure of 15-20 inches of mercury on the soil water sampler. The PVC pipe was covered with a removable PVC cap which was flush with the ground surface.

Lysimeter Sampling

The lysimeters were sampled by removing the access cover and extracting the discharge and pressure vacuum tubes. The clamps used to seal off the ends of both tubes were then removed. The discharge access tube was inserted through a rubber stopper which was attached to the top of an acid-washed 1 L filter flask. A hand held vacuum pump was then attached to the flask side arm and a vacuum was applied causing the contents of the lysimeter to collect in the flask. The sample was transferred to a 1L acid-washed Nalgene sampling bottle for analysis.

Finally, a vacuum pressure (15-20" of mercury) was reapplied to the lysimeter by clamping off the discharge access tube and using the hand held pump to apply the vacuum via the pressure vacuum access tube. The pressure vacuum access tube was clamped off, the tubes were stuffed down inside the PVC pipe, and then the pipe was capped. The lysimeter samples were analyzed for nitrate, ammonium, phosphate, pH, and salinity.

Soil Coring Of EDAs

At five sites the EDA area was cored to investigate microbial transport between the bottom of the EDA (gravel/soil interface) and the water table. A post-hole digger was used to manually excavate below the EDA to the gravel/soil interface. A 4" PVC pipe was inserted into the hole to prevent collapse of the surrounding soil material during the coring process. Cores were obtained using an 18-inch split-spoon soil corer inserted with a 1.5-inch diameter sterile sleeve to maintain sterility and core integrity during transport. Between cores, the two halves of the split spoon were rinsed with distilled water, a new sterile sleeve was inserted, and the bit and core retainer were sterilized using methanol and an open flame.

The distance between the water table and the bottom of the EDA was estimated by measuring the depth to the water table from the TOC of the nearest well. A sledge hammer was used to drive the soil corer to the desired depth. Several cores were taken below each EDA in order to sample the entire distance between the bottom of the EDA and the water table. Core samples were placed on ice and transported back to JEL for analysis. Soil cores were analyzed for fecal coliforms, *E. coli*, and *C. perfringens* using standard multiple-tube fermentation techniques.

Soil Core Transects

Soil core transects were conducted at sites WRH and REH to investigate the horizontal transport of microbes in the upper foot of the water table, downgradient of the EDA's. Site WRH was transected in the direction of prevalent groundwater flow from the down gradient edge of the leachfield towards the adjacent salt marsh and surface waters. Cores were taken 1, 3, 9, and 27 feet away from the EDA. In addition, a core was taken within the EDA and up gradient from the EDA as a control. Site REH, which is tidally influenced, was transected in three directions away from the EDA due to the varying groundwater direction. The transects were sampled at distances of 1, 3, and 9 feet away from the EDA. A control core was taken approximately thirty feet away from the EDA while no core was taken within the EDA at site REH.

Water levels were measured in all of the wells at each site to estimate the water table depth below the ground surface. A post-hole digger was then used to excavate down to the water table before samples were taken with the split-spoon soil corer. Samples were stored on ice in a cooler and transported back to JEL for analysis. Soil cores were analyzed for fecal coliforms, *E. coli*, and *C. perfringens.*

Water And Soil Sample Analysis

Samples brought back to JEL were processed for the different analyses, and salinities were recorded using a refractometer. Approximately 500 mls of the nutrient samples were prefiltered through 0.45μm pore size filters. The filtrates were frozen until analysis for ammonium, nitrate and orthophosphate using a LACHAT autoanalyzer. The prefilter was dried and weighed to determine total suspended solids and percent organic matter. Microbiological samples were prefiltered using a Whatman 41 (20-25 μm nominal pore size) filter to remove fine suspended sand and silt particles. A steady flow was maintained during vacuum filtration and filters were replaced if filtration rate decreased because of solids build up on the filters. Filtrates were collected in sterile filter flasks and transferred to sterile sample bottles. Appropriate volumes of filtrates were then filtered through 0.45 μm pore size Gelman membrane filters (enterococci, fecal coliform and *E. coli*) or 0.7 μm pore size Millipore membrane filters (*C. perfringens*). Filters were incubated on mTEC agar for fecal coliform and *E. coli*, mE agar for enterococci and on mCP agar for *C. perfringens* analyses. Plates were incubated at 44.5°C for 24 h for all but enterococci, which were incubated at 41°C for 48 h.

Soil core samples were analyzed for fecal coliforms, *E. coli*, and *C. perfringens* using the five-tube fermentation technique reported as Most Probable Number (MPN). 1.0 ± 0.05 grams of wet sediment from the center of each core was added to 9.6 mls of sterile buffered peptone water (BPW) and vortexed for 30 seconds to achieve a 10^{-1} dilution. Additional decimal dilutions were prepared for multiple-tube fermentation analysis. Fecal coliforms and *E.coli* MPN's were determined by using EC with MUG media incubated at 44.5°C for 24h. *C. perfringens* densities were determined using iron-milk media incubated at 45°C for 24h

There were two notable developments in this study that warrant mention before reviewing the results of wellwater data. First, initial samples were processed by mixing water with soil particles (M; Table 8, FILTER column) or allowing the prevalent soil particles to settle (S), then analyzing the supernatant. This process resulted in the detection of relatively high levels of bacterial contaminants that remained attached to suspended particles. The sampling and processing protocols were then changed to include prefiltration (PF) to avoid including particulate matter in water samples. However, the initial values were valuable to detect the presence of bacteria from the subsurface at these well sites, even though many of the detected bacteria were probably attached to particles. Second, the changes in groundwater flow direction at some sites shows how detection of contaminant plumes in the subsurface can be complicated as contaminant concentration gradients in groundwater become blurred as contaminants are transported to different sites. The changes measured as part of this study are probably indicative of previous changes in flow direction. Thus, contaminants that persist at previous downgradient sites may remain detectable at later upgradient sites.

The following is a series of discussions about each site and the within site trends and conditions. Sample dates, 10-15 for each site, are presented in Table 9. Table 8 is a summary of all data, and is separated into sub-tables, labeled 8A-8J, for each site. The dates for which there are no data presented (labeled NO B/N under FILTER column; no bacteria/nutrients) were days in which the wells did not produce. The sites where sampling was most problematic are sites REH on River St. and FDC, the site abutting a non-tidal marsh on Forest Drive. Some wells produced on every sample date, while others at some sites produced infrequently. In general, the in-town sites, developed on natural soils, produced better than the River St. sites, which were developed on sandy fill over wetlands.

Results

Seabrook Site Assessments

WRH

The EDA at this site was raised by fill and lies within 50 feet of poorly drained soils and the marsh. ANOVA revealed statistically significant differences between wells at this site for all nutrient and microbial parameters ($p < 0.01$). Vertical transport of NO_3, NH_4· and PO_4 in septic tank effluent to groundwater was apparent from the elevated concentrations of these constituents in groundwater below the EDA, above background levels (Fig 24A & B). Compared to typical mean background concentrations of NO_3, NH_4, and PO_4 in the area, 2.0 mg/L, 0.07 mg/L, and 0.01 mg/L, respectively, the levels in groundwater below the EDA increased to 4.6 mg/L, 9.3 mg/L, and 0.04 mg/L (well 5).

Statistical analysis supports the observed vertical transport of N below the EDA since there were no differences in DIN levels found in the lysimeter or EDA wells 5 and 3D which had mean concentrations of 20.6 mg/L, 13.9 mg/L and 18.0 mg/L, respectively. Phosphorus also exhibited minimal vertical attenuation between the bottom of the EDA and the water table since there was no significant difference between the level of P in the lysimeter and EDA wells 4 and 5 which had mean concentrations of 0.12 mg/L, 0.34 mg/L, and 0.04 mg/L, respectively. Attenuation of P appears to occur within the groundwater zone as evident by the significant reduction between the shallow (4) and deep well (3D) coupling from 0.34 mg/L to 0.03 mg/L, respectively (Fig. 24B).

Lateral transport of N was observed as DIN levels increased significantly above background below and to the edge of the EDA, decreased at 27 ft downgradient of the EDA (well 6), and then increased further downgradient at wells 8 and 9 (Fig. 24A). Mean DIN concentrations, below and downgradient of the EDA of >15.0 mg/L were common. Nitrogen below the EDA was present primarily as NH_4 with NO_3 levels roughly half those of NH_4.

Conversely, NO_3 was the dominant form of N detected in the downgradient wells (6, 7, 8, and 9) and was present at concentrations which exceeded the drinking water limit of 10 mg/L (wells 8 & 9). Phosphorus was significantly elevated above background in shallow groundwater as far as the edge of the EDA (well 4) but was significantly reduced in both the vertical (well 3D) and downgradient directions (wells 6, 7, 8, 9, 10) (Fig. 24B).

Vertical transport of fecal indicator bacteria (fecal coliforms, *E. coli*, enterococci, and *C. perfringens*) was evident from the consistent detection of these indicators below the EDA (well 5). Geometric mean levels of 90, 46, 42, and 0.48 cfu/100 ml for fecal coliforms, *E. coli*, enterococci, and *C. perfringens*, respectively, were detected in the EDA well (5) over the sampling period (Table 8). Fecal coliforms, *E. coli*, enterococci, and *C. perfringens* were detected at the edge of the EDA (well 3D), at 1.5, 1.5, 0.25, and 0.25 cfu/100 ml, respectively, on only one occasion, and therefore illustrate the limited penetration of bacteria into deeper groundwater zones.

Lateral migration of bacteria to the edge of the EDA was apparent from the high levels of indicator bacteria detected there. Geometric mean levels of 592, 512, 8.5, and 1.6 cfu/100 ml for fecal coliforms, *E. coli*, enterococci, and *C. perfringens*, respectively, were detected at the downgradient edge of the EDA (well 4). This well contained significantly higher levels of fecal coliforms and *E. coli* than all other wells except EDA well 5. Bacteria showed limited mobility in the downgradient direction as fecal coliforms were never detected in any of the downgradient wells while enterococci and *C. perfringens* were only detected occasionally and at low levels (<1.5 cfu/100 ml) in well 6.

Groundwater elevations plotted over the sampling period show that the watertable fell from approximately 1.25 to 3.0' below the bottom of the EDA from March to August ,1995 (Fig. 24C). A sharp rise in the watertable to the bottom of the EDA occurred in November, 1995 and fluctuated within roughly one foot below the bottom of the EDA thereafter. Ammonium levels in EDA well (5) were greater than 18 mg/L during April and May, 1995 when the watertable was roughly 2 feet below the EDA (Fig. 24D). From November, 1995 to May, 1996, the time period during which the water table fluctuated just at or below the bottom of the EDA (when reducing conditions were greatest), a decrease in NH_4 to < 5.0 mg/L was observed. Conversely, NO_3 was greatest (>17 mg/L) during November, 1995, after the water table rose sharply. This probably resulted from the input of soluble NO_3 present in the unsaturated zone, from previous oxidizing conditions, to groundwater as the watertable rose. Phosphate levels in the EDA well showed no relationship to groundwater table depth.

There appeared to be no significant relationship between watertable depth and the prevalence of a particular N-species in the vadose zone (Fig. 24E). In fact, nitrate is the dominant form of N below the bottom of the EDA even under probable reducing conditions (November, 1995) when the vadose zone became saturated (Fig 24E).

CSL

The EDA at this site consists of a leach field and a dry well that are within 60 feet of poorly drained soils. ANOVA showed that there were significant differences between NO_3, NH_4, PO_4, and *C. perfringens* levels in wells at this site ($p < 0.01$). Vertical transport of NO_3 and NH_4 to groundwater occurred below the EDA (well 4) as mean concentrations of these constituents were elevated 2 and 3 fold, respectively, above background (well 1 & 2) concentrations (Fig. 25A). The EDA well (4) had significantly higher DIN concentrations than either of the upgradient wells (1 & 2). Additionally, there was no significant difference between DIN levels in the lysimeter and those in the EDA well (4), indicating that minimal attenuation of N occurred between the bottom of the EDA and the watertable. Well 3, at the downgradient edge of the EDA, had significantly higher DIN concentrations than both upgradient and downgradient wells, further supporting the observed vertical transport of N. Statistically, there was no significant difference between P concentrations in the lysimeter and in the EDA well (4). However, mean PO_4 concentrations in the lysimeter and

EDA well (4) of 4.6 mg/L and 0.08 mg/L suggest attenuation of PO_4 as it migrates vertically below the EDA.

Lateral transport of N appears to be limited to shallow groundwater at the edge of the EDA (well 3) as DIN levels decreased to background concentrations in the deeper well at the edge of the EDA (5D) and at the downgradient well (6) (Fig. 25A) Additionally, N appears to be undergoing nitrification as it migrates laterally downgradient as evident by the increase in NO_3 and decrease in NH_4. It also appears that denitrification or dilution is occurring as DIN levels also decrease with distance from the EDA. No lateral transport of P was observed (Fig. 25B) as evident by background concentrations of <0.01 mg/L of PO_4 in all wells except EDA well 4.

Vertical transport of fecal indicator bacteria was evident at this site as at least two, and more commonly all four, indicator bacteria were detected at all wells on one or more sampling dates. Relatively higher levels and more frequent detection occurred in the EDA well (4) with fecal coliforms, enterococci, and *C. perfringens* ranging from 0-53, 0-48, and 0-22 cfu/100 ml, respectively. However, geometric mean levels of all indicators in the EDA well were <1.0 cfu/100 ml. *C. perfringens* was detected at significantly higher levels in the EDA well (4) than all other wells. Less frequent detection of indicator bacteria and at relatively lower concentrations occurred in the deep well (5D) at the edge of the EDA indicating that minimal transport of bacteria through the watertable occurred. Lateral transport of bacteria to downgradient well 6 occurred on only three of 14 sampling dates. Only fecal coliforms and *E. coli* were detected and only then at relatively low levels (< 2.2 cfu/100 ml).

Groundwater elevations plotted over the sampling period show that the watertable fell from approximately 0.5 to 2 feet below the bottom the EDA from February to August, 1995 (Fig. 25C). The watertable rose sharply after August, 1995 and peaked at approximately 1 foot above the bottom of the EDA in February, 1996 and then gradually decreased to roughly 1' below the bottom of the EDA in June, 1996. Ammonium levels in groundwater below the EDA were greatest (>17 mg/L) from April to June, 1995 when the watertable was approximately 1 foot below the bottom of the EDA (Figure 25D). NH_4 levels decreased thereafter to < 2.0 mg/L despite inundation of the EDA by the watertable in February, 1996. Nitrate levels seemed to be more variable but did peak at 17.9 mg/L in October of 95 which coincided with a sharp rise in the watertable. A similar increase in NO_3 with a sharp rise in the watertable was observed at site WRH and was attributed to NO_3 present in the soil matrix from previous unsaturated and likely oxidizing conditions. Phosphate levels in groundwater below the EDA did not appear to be affected by watertable depth, however, one of the largest levels of PO_4 (0.24 mg/L) occurred when the watertable peaked at slightly less than a foot above the bottom of the EDA in February, 1996.

Nitrate levels in the lysimeter were inversely related to the depth of the watertable below the bottom of the EDA (Fig. 25E). Lysimeter NH_4 levels were consistently low (< 1 mg/L) throughout the sampling period except for conditions where the lysimeter was in saturated conditions. In February, 1996, NH_4 exceeded 9 mg/L and coincided with the maximum rise in the watertable, and in June, 1996, NH_4 exceeded 24 mg/L when the watertable was slightly less than a foot below the bottom of the EDA. Phosphate levels in the lysimeter remained consistent throughout the sampling period, fluctuating between 3 and 6 mg/L, and were not affected by saturated conditions induced by the rise in the watertable.

KDBM

This state-approved system lies within 100 feet of poorly drained soils and marsh, and is adjacent to an identical system that serves the other half of the duplex. ANOVA revealed that there are statistically significant differences between wells at this site for NO_3 and DIN only ($p < 0.01$). The fact that there is no significant difference between either of the upgradient wells (1 & 2) and the EDA well (3) for any of the nutrient parameters would seem to indicate that there is no vertical transport of nutrients to groundwater below the EDA. However, this interpretation is misleading.

Downgradient wells (5 & 7) have significantly higher levels of nitrate than the EDA well (3) or upgradient well (1) and clearly indicate that the groundwater below and downgradient of this system is impacted primarily with nitrate (Fig. 26A). The EDA well may not have intercepted the contaminant plume and thus may explain why expected elevated levels of nutrients are not present in this well. The lysimeter at this site had mean NO_3, NH_4 and PO_4 concentrations of 24, 9.4, and 12.7 mg/L, respectively, while the EDA well had much lower levels of 6.3, 0.78, and 0.01 mg/L, respectively.

Lateral transport of nitrate is evident by the significantly higher levels in downgradient wells, 5 and 7, which had mean NO_3 concentrations of 19.4 and 21.4 mg/L, respectively. These levels of nitrate are nearly double the permissible levels allowed in drinking water (10 mg/L). In addition, nitrate levels in well 12, which is approximately 43 m downgradient of this system, had NO_3 concentrations in excess of 14.9 mg/L during April and May of 1996. Phosphorus, which had a mean concentration of >12.0 mg/L in the lysimeter, showed no vertical transport to the water table as evident by the fact that the PO_4 concentration in the lysimeter was significantly higher than EDA well 3 (Figure 26B). In addition, there was no significant difference between any of the wells at this site for PO_4.

Low levels of bacteria were detected in all wells at this site except downgradient wells 10-15, where no bacteria were detected. There was no significant difference in levels of bacteria between wells. Fecal coliforms, *E. coli*, and *C. perfringens* were detected in the EDA well (3) and ranged from 0-75, 0-72, and 0-51 cfu/100 ml, respectively, with only a few organism generally being detected on most sample dates. Low levels of bacteria also appeared to be transported laterally as indicated by the detection of all fecal indicators or only *C. perfringens* in wells 7 and 5, respectively. Again, only a few organisms were detected on most sampling dates with geometric mean levels for the entire sampling period being <1 cfu/100 ml for all indicators in all wells.

Groundwater elevations slowly dropped from approximately 3 to 5.5 feet below the bottom of the EDA from March to August, 1995 (Fig. 26C). After August, 1995 the watertable rose sharply to roughly 3 feet below the EDA in February, 1996 and then slowly dropped to 3.5 feet below the EDA in May, 1996. Ammonium concentrations in groundwater below the EDA averaged <1.0 mg/L during the entire study and is indicative of the unsaturated, oxidizing conditions below the EDA over this time period (Fig. 26E). Nitrate concentrations were lower than expected, < 7 mg/L for most sample dates, although they did reach 25 and 13 mg/L in June, 1995 and February, 1996, respectively. Phosphorus concentrations below the EDA were extremely low and never exceeded 0.06 mg/L.

Of the four lysimeter samples obtained at this site, two were taken in August and September, 1995 while the remaining two were taken in June, 1996 (Fig. 26H). Nitrate was greater than 19 mg/L during all samples dates while NH_4 decreased from greater than 17 mg/L on the first two dates to < 2 mg/L in June, 1996. It is unclear why NH_4 was so high during August and September, 1995, especially in light of the fact that the watertable was greater than 2 feet below the lysimeter, providing adequate oxidizing conditions. Phosphorus increased from 5 and 7 mg/L in August and September, 1995, respectively, to >17 mg/L in June, 1996. Perhaps the high levels of NH_4 and PO_4 were associated with elevated loading conditions where N-transformation such as nitrification would have less time to take place and where PO_4 would be less quickly adsorbed. Ammonium and PO_4 levels in lysimeter samples did not show any clear association with watertable depth below the EDA while nitrate was always present at high levels, as expected, due to unsaturated conditions.

KDBS

This state-approved system lies within 100 feet of poorly drained soils and marsh, and is adjacent to an identical system that serves the other half of the duplex. ANOVA revealed statistically significant differences between wells at this site for NO_3, DIN, and PO_4 ($p < 0.01$), while there were no differences in bacterial levels between any wells. Vertical transport of NO_3 to groundwater was evident as NO_3 increased from the upgradient well (2) to the EDA well (4) with mean concentrations of 2.3 mg/L and 16.1 mg/L, respectively (Fig. 26A). In addition, there were no significant differences between NO_3, NH_4, and DIN concentrations in the lysimeter and the EDA well (4), further supporting the observed vertical transport of N. Nitrate was the dominant form of N in the EDA and downgradient wells (6 & 8) as a result of the oxidizing conditions below the EDA due to a watertable depth of greater than 3 feet below the bottom of the EDA during the entire study period (Fig. 26D). Mean NH_4 concentrations were less than 1.4 mg/L in all wells. The lysimeter had significantly higher concentrations (mean = 14 mg/L) of PO_4 than all other wells which had mean concentrations of $PO_4 < 0.05$ mg/L. There was no vertical transport of PO_4 as it was attenuated within the unsaturated zone below the EDA.

Lateral transport of N in the downgradient direction, primarily as NO_3, is apparent (Fig. 26A) as the downgradient wells (6 & 8) were significantly higher in NO_3 than the upgradient well (2). No lateral migration of P occurred as PO_4 was attenuated in the unsaturated zone below the EDA as mentioned earlier.

No fecal indicator bacteria were detected in the EDA well (4) on any of the 6 sampling dates. However, low levels of fecal coliforms, *E. coli*, enterococci, and *C. perfringens* ranging from 0-7.5, 0-7.25, 0-1.75, and 0-0.5 cfu/100 ml, respectively, were detected on a few occasions in downgradient well 6. Fecal coliforms, enterococci, and *C. perfringens* were occasionally detected at very low levels (<2 cfu/100 ml) in downgradient well 8. The microbiological data indicates that vertical and lateral migration of bacteria below the EDA at this site is inhibited and is unlikely to substantially impact groundwater quality.

The watertable depth below the EDA at this site remained at about 4 feet below the bottom of EDA from March, 1995 to May, 1995 and then dropped to approximately 6.5 feet below the EDA in August, 1995 (Figure 26D). The watertable increased after August, 1995 to roughly 3 feet below the bottom of the EDA in February, 1996 and then gradually decreased to 4 feet below the EDA in May, 1996. Nitrate concentrations in groundwater below the EDA decreased gradually from approximately 20 mg/L in March, 1995 to roughly 12 mg/L in May, 1996 (Figure 26F). Ammonium and phosphate levels, on the other hand, remained relatively constant and never exceeded 1.30 or 0.06 mg/L, respectively.

Nitrate in lysimeter samples generally varied between 18 and 21 mg/L from August, 1995 to April, 1996 and seemed to be unaffected by changes in watertable depth (Fig. 26G). Phosphorus concentrations also varied but exhibited an increasing trend over time with a peak of approximately 22 mg/L in February, 1996 which coincided with the maximum rise in the watertable. Ammonium concentrations declined from 17 mg/L in August, 1995 to <1 mg/L from September, 1995 to November, 1995 then peaked at >15 mg/L in February, 1996 which coincided with the maximum water table rise.

REH

The EDA at this site consisted of separate graywater and blackwater leaching areas located very close to the marsh edge, so that the surface of the leach field was often under water at high tide. ANOVA revealed that there are statistically significant differences between wells at this site for NH_4 and DIN only ($p < 0.01$). Vertical transport of N is apparent since the well at the edge of the EDA (5) has significantly higher levels of NH_4 and DIN then the upgradient well (1). Elevated levels of NH_4 and DIN in downgradient wells 2 and 5, above background levels (well 1), can be seen in Figure 27A. There appears to be vertical transport of PO_4 to the deep well (6D), which has a mean concentration of >0.4 mg/L, despite there being no significant difference between any wells for PO_4. The fact that PO_4 levels in 6D are not significantly elevated could be due to the fact that the upgradient well (1) is also elevated with a mean concentration of >0.16 mg/L (Fig. 27B).

Lateral transport of N away from the EDA is evident from the elevated levels of N in the downgradient well (2), primarily as NH_4. Mean NH_4 and NO_3 levels in well 2 were 12.5 and 5.8 mg/L, respectively, while mean NH_4 levels in the upgradient well (1) were <1.0 mg/L. Well 2 was significantly higher in NH_4 and DIN than the upgradient well (1). Downgradient wells 7 and 8, which are located in the tidal stream which traversed the downgradient edge of the property, had lower levels of DIN, primarily as NH_4, than observed in wells 5 and 2 (Fig. 27A). However, mean levels of NH_4 in wells 7 and 8 were 3.5 and 2.2 mg/L, respectively, which were still slightly elevated above the upgradient well (1) which had a mean NH_4 concentration of 0.79 mg/L. Lateral transport of P was less apparent. Elevated levels of PO_4 relative to known background concentrations were found in the upgradient well (1), the deep well (6D), and downgradient wells 7 and 8 which had mean concentrations of 0.16, 0.41, 0.12, and 0.19 mg/L, respectively. Elevated levels of P in the downgradient wells 7 and 8 could not be attributed to the influence of surface waters present in the tidal creek since mean PO_4 levels in these surface waters were <0.06 mg/L. No significant trend of PO_4 in groundwater from the upgradient well (1) to the downgradient wells (2, 7, & 8) makes it difficult to assess PO_4 transport mechanisms. It appears that PO_4 is smeared across this site which probably results from the changes in groundwater flow direction and the tidal inundations, which occur twice each day during high tides.

Vertical and lateral transport of bacteria was minimal at this site. Fecal coliforms, *E. coli*, enterococci, and *C. perfringens* were detected only once at the edge of the EDA (well 5) at 0.5, 0.5, 0.5, and 5 CFU/100 ml, respectively. Fecal coliforms and *E. coli* were detected in the deep well (6D) on one date at 7 and 0.75 CFU/100 ml, respectively. No bacteria were detected in any other wells (1, 2, 3, 4, 7 & 8) using the membrane filtration protocol. It should also be noted that very few samples were obtained from these wells, generally < 5 samples. MPN analyses of samples that were prefiltered showed *C. perfringens* levels of 700, 63, and 500 CFU/100 ml in wells 1, 2, and 5, respectively, on one sampling date. These higher counts were likely associated with the increased attachment of bacteria to the suspended solids content of these samples which is why the MPN method was necessary. The low levels of bacteria detected in prefiltered groundwater at this site seem to indicate that both vertical and lateral migration of bacteria is inhibited and that microbiological impact on groundwater quality at the study wells is minimal. However, the evidence from the unfiltered samples suggests that lateral transport does occur. A better conclusion is that few free-floating bacteria were present in the wells sampled, but there is ample evidence of transport, recent or historical, in many of the wells.

The watertable at this site was at or above the assumed bottom of the EDA during the entire study except for July, 1995 when the watertable dipped to approximately 0.5 feet below the bottom of the EDA (Fig. 27C). Ammonium was the dominant form of N below the EDA (well 5) because of the reducing conditions present below the EDA and was consistently >17.0 mg/L (Fig. 27D). Nitrate was <0.3 mg/L in four out of the six samples but did peak twice in December, 1994 and October, 1995, when concentrations reached greater than 15 and 12 mg/L, respectively. The October, 1995 peak appeared to be associated with a one foot drop in the watertable. Phosphorus levels in the EDA (well 5) were very low (<0.02 mg/L) throughout the study period.

It seems possible that denitrification could be occurring at this site due to prevalence of reducing conditions from the extremely high water table. A substantial reduction in DIN between wells 5 and 2 and downgradient wells 7 and 8 would support this. There is probably an abundance of organic-C, potential electron donating substrate required for denitrification, present in the subsurface since this area was filled over an organic matter-rich saltmarsh. The reduction in DIN away from the EDA could also result from other factors like dilution and ammonium adsorption.

RET

The EDA at this site lies within 75 feet of poorly drained soils with mottling observed at 20 inches in the fill near the EDA. ANOVA showed that there are significant differences between wells at this site for NO_3, NH_4, and DIN ($p < 0.01$). Groundwater monitoring at this site suggested that the downgradient direction is toward well 3. Vertical transport of N directly below the EDA was minimal as evident by the slightly elevated levels of NO_3, NH_4, and DIN above background wells 4 and 5 (Fig. 28A). In addition, there were no significant differences between levels of NO_3, NH_4, and DIN in the EDA well (6) and the upgradient wells (4 & 5). Downgradient wells 2 and 3, which have mean DIN concentrations of 12.0 and 11.7 mg/L, respectively, are significantly higher in DIN than both upgradient wells 4 and 5, which have a mean DIN level of approximately 1.2 mg/L. The elevated levels of DIN, primarily as NH_4, in downgradient wells indicates that vertical transport of N below the EDA is occurring despite not being detected by the EDA well (6). Phosphorus below the EDA (well 6) is elevated (mean = 0.29 mg/L) above background wells (Fig. 28B) but is not statistically higher than any of the other wells, suggesting that vertical P transport is minimal.

As mentioned previously, lateral transport of N, primarily as ammonium, has been detected in downgradient wells 2 and 3, based on the significantly higher levels of DIN in these wells, mostly as NH_4, above upgradient wells (4 and 5). No lateral transport of P was observed as there were no significant differences in PO_4 concentrations between any of the wells. Slightly elevated levels of PO_4 were measured in the downgradient well (3) which had a mean concentration of 0.04 mg/L.

Vertical transport of indicator bacteria below the EDA was limited. Fecal coliforms, enterococci, and *C. perfringens* were each detected once out of 4 samples below the EDA (well 6). Fecal coliforms and *C. perfringens* were detected in unfiltered samples using MPN analysis at 20 and 40 MPN/100 ml, respectively, while enterococci was detected at 0.25 cfu/100 ml using membrane filtration in well 6. Downgradient well 2 had the most consistent detection of bacteria with geometric mean levels of fecal coliforms, *E. coli*, enterococci, and *C. perfringens* equal to 0.71, 0.70, 7.53, and 0.57 cfu/100 ml, respectively. All other wells had geometric mean levels <1 cfu/100 ml for all indicators. Detection of indicator bacteria infrequently at relatively low levels for all wells at this site suggests minimal vertical and lateral mobility of bacteria.

Groundwater depths plotted over time show that the watertable below the EDA dropped from just at the ground surface in March, 1995 to roughly 2 to 2.5 feet below the bottom of the EDA after May, 1995 (Fig. 28C). It is difficult to assess any relationship between watertable depth below the EDA and the prevalence and concentration of NO_3, NH_4 or PO_4, since only three nutrient samples from this well were obtained (Fig. 28D). Clearly, the high levels of DIN in downgradient wells 2 and 3, primarily as NH_4, indicate that reducing conditions prevail around the EDA, making it unlikely that nitrification and subsequent N loss due to denitrification will occur.

RB

The EDA at this site consisted of a cesspool and a dry well, both within 30 feet of very poorly drained soils and the highest observable tide. The system was rarely used, as the cottage was vacant most of the time. ANOVA revealed that there are no significant differences between wells for any of the nutrient or microbial parameters at this site at the $p = 0.05$ level. Groundwater concentrations of NO_3, NH_4, and DIN averaged <2.0 mg/L in all wells (Fig. 29A) and are similar to background concentrations seen at sites CSL (wells 1 & 2), REH (well 1), and RET (wells 4 & 5). The relatively low concentration of NO_3 and NH_4 in groundwater samples suggests that there is limited vertical and lateral transport of N at or to this site. However, mean PO_4 concentrations of 0.54, 0.22, 0.26, and 0.14 mg/L in wells 1, 2, 3, and 4, respectively, indicate lack of P attenuation and extensive transport in the vertical and lateral directions (Fig. 29B). The cumulative effect of subsurface loading from the high density of homes in this area may have exceeded the soils natural adsorptive capacity of the soils and contributed to the enrichment of groundwater with P.

No bacteria were detected in the upgradient well (1) which only yielded two samples during the study period. Fecal coliforms, *E. coli*, and enterococci were detected occasionally and at low levels (<3 CFU/100 ml) in downgradient wells 3 and 4 using standard prefiltration protocol. Higher levels (10 to 100x) of enterococci and *C. perfringens* were detected using MPN analysis. Fecal coliforms, *E. coli*, and enterococci were consistently detected in the well closest to the EDA (2) at low levels, i.e., geometric means ≤1 CFU/100 ml. The microbiological data indicate that there is limited vertical and lateral migration of bacteria to or away from the EDA at this site.

Evaluation of groundwater depths throughout the study period show that the watertable fluctuated between 2 and 2.5 feet below the estimated bottom of the EDA most of the time (Fig. 29C). Nitrate concentrations in the EDA well (2) peaked at 0.23 mg/L but were typically less than 0.03 mg/L (Figure 29D). Ammonium levels in the EDA well reached as high as 11.1 mg/L in March, 1996 but were well below 1 mg/L in eight out of eleven samples taken between December, 1995 and March, 1996. Phosphorus levels in the EDA well also peaked in March, 1996 at 0.52 mg/L. There did not appear to be any relationship between watertable depth and nutrient levels in the EDA well (2). Nitrogen does not appear to be transformed with migration in the downgradient direction. Mean NH_4 and DIN levels decrease from 1.7 and 1.8 to 0.80 and 0.93 mg/L from the EDA well (2) to the downgradient well (4), respectively. This decrease could be attributable to dilution, ammonium adsorption or denitrification.

RH

The EDA at this site was located on a narrow piece of property squeezed between the property owner's home and the driveway of the abutting property. It is 85 feet to very poorly drained soils and the highest observable tide. ANOVA revealed that there are statistically significant differences between wells for all parameters at this site ($p < 0.05$) with the exception of DIN, PO_4 and *C. perfringens*. Groundwater monitoring has shown that subsurface flow is toward wells 1 and 2. There appears to be limited vertical transport of N to groundwater in EDA wells 3 and 5D, which have mean DIN levels of 2.3 and 2.1 mg/L, respectively (Fig. 30A). These DIN levels are statistically the same as background concentrations observed within this site (well 4) and are similar to background concentrations at sites REH (well 1), RET (well 4 & 5D), and CSL (well 1 & 2). Elevated mean levels of DIN, primarily as NO_3, in downgradient wells 1 and 2 indicates that some vertical transport of N occurs albeit at lower concentrations observed below other EDA's. The mean nitrate concentration of 5.84 mg/L in downgradient well 1 was significantly higher than the mean nitrate level of 0.43 mg/L observed in the upgradient well (4). This observation supports the vertical transport of N with subsequent downgradient migration to well 1. Vertical and lateral transport of PO_4 was apparent as mean concentrations ranged from 0.131 mg/L in downgradient well 1 to 2.1 mg/L in the EDA well (5D; Figure 30B). There were no statistical differences between any wells for DIN or PO_4 indicating that there is a "smearing" of these nutrients throughout the site.

Fecal coliforms, *E. coli*, and enterococci below the EDA (well 3) ranged from 0-500, 0-470, and 0-4.5 cfu/100 ml, respectively, with levels <2 cfu/100 ml being more typical. The downgradient well (1) had the greatest geometric mean levels of fecal coliforms, *E. coli*, and enterococci of any well with 18.5, 16.9, and 1.5 cfu/100 ml, respectively. Enterococci were the only indicator bacteria detected in the EDA deep well (5D) on two occasions and only at levels <0.5 cfu/100 ml. *C. perfringens* was never detected in any of the wells using the standard prefiltration protocol. However, it was detected in wells 1, 2 and 3 at levels as high as 285, 10, and 145 MPN/100 ml, respectively, using the MPN method. The downgradient well (1) had significantly higher levels of fecal coliforms and *E. coli* than all other wells, which suggests that there is substantial lateral microbial transport occurring approximately 10 feet downgradient of the EDA. The detection of enterococci only, at infrequent and very low levels, in well 5D, suggests that vertical migration of bacteria to deeper groundwater zones is inhibited.

Watertable depth below the estimated bottom of the EDA (well 3) was always greater than 4 feet with the largest separation, 6 feet, occurring in June, 1995 (Fig. 30C). The highest concentration of NO_3 measured below the EDA (well 3) occurred in December, 1994 when >13.0 mg/L was detected (Fig. 30D). Nitrate levels fluctuated between 0 and 3 mg/L thereafter with NO_3 levels <0.30 mg/L prevailing after July, 1995. Ammonium levels fluctuated slightly less over the same time period and typically remained <1.0 mg/L. Neither NO_3 or NH_4 concentrations in groundwater below the EDA appeared to be affected to any great extent by watertable levels. Phosphorus peaked in March, 1995 at 1.11 mg/L and appeared to coincide with the maximum recorded watertable rise.

Nitrogen from the septic system appears to be undergoing nitrification as it migrates in the downgradient direction since NO_3 is the prevalent N species in wells 1 and 2. We would expect to detect this oxidized form of N in groundwater due to the large separation between the bottom of the EDA and the watertable at this site. It is difficult to assess whether denitrification is occurring since true DIN levels below the EDA area were not likely measured because of well placement.

RP

This site is served by a single EDA which is approximately 90 feet to very poorly drained soils and the highest observable tide. ANOVA showed that there were no significant differences between wells for any parameter except NO_3. Mean DIN levels ranged from 1.3 to 3.4 mg/L in wells across this site (Fig. 31A) and are similar to background concentrations observed at other sites in this area such as well RH-4, REH-1, and RET-4 & 5. Slightly elevated levels of N (mean DIN = 2.9 mg/L), primarily as NO_3, occurred in the EDA well (1). Similar DIN levels were also observed in the downgradient well (3) with mean NO_3 and NH_4 present at roughly equal concentrations of 1.8 and 1.7 mg/L, respectively. The relatively low concentration of DIN present in wells at this site suggest limited vertical and lateral transport. The only statistically significant difference found between wells was that the downgradient well (3) was significantly higher ($p < 0.01$) in NO_3 (mean = 1.8 mg/L) than EDA wells 1 and 5D which had mean NO_3 concentrations of 2.2 and 0.04 mg/L, respectively. Mean PO_4 levels ranged from 0.18 to 1.8 mg/L in the shallow and deep EDA well, 1 and 5D, respectively (Fig. 31B). These highly elevated concentrations are similar to P levels observed at other sites on this street (RH, RC, and RB) and suggest significant vertical and lateral transport of P throughout this area.

Wells placed downgradient of this site, along the beach interface (wells RP/RC 1-4), showed slightly lower levels of DIN than upgradient wells, primarily as NH_4, with the exception of the deep well RP/RC-4D. This well had a mean DIN concentration of >1.5 mg/L which was similar to the EDA well 5D. PO_4 levels in the RP/RC wells were slightly elevated over there upgradient counterparts and had mean PO_4 concentrations >0.25 mg/L. These elevated levels in the downgradient beach interface wells suggest that PO_4 is being transported to surface waters at this site.

Detection of indicator bacteria in well water samples was infrequent and often at very low levels, typically <0.5 cfu/100 ml. Fecal coliforms and *E. coli* were detected once, at elevated levels, in the shallow EDA well (1) at 71 and 42 cfu/100 ml, respectively. Infrequent detection of bacteria in all wells and at very low levels suggests that both vertical and lateral migration of bacteria is limited at this site.

Groundwater monitoring over the study period showed that the watertable was consistently greater than 4.5 feet below the estimated bottom of the EDA from March, 1995 to April, 1996 with minor fluctuations (Fig. 31C). Nitrate concentrations below EDA well 1 peaked at 14 mg/L in February, 1995 and sharply decreased to <0.75 mg/L throughout the rest of the study (Fig. 31D). Ammonium concentrations below the EDA remained relatively constant, fluctuating between 0.31 and 2.5 mg/L. Phosphate peaked in June, 1995 at 0.89 mg/L. There was no correlation between watertable depth below the EDA and levels of measured nutrients.

It is difficult to assess N-transformations and dynamics below this system since groundwater is moving in several different directions at this site. One observation which can be made is that the watertable depth below the EDA should provide an adequate aerobic zone for nearly complete nitrification to occur. However, mean NH_4 concentrations in groundwater samples were greater than or equal to NO_3 concentrations in wells 2, 3, 4, and 5D. Perhaps these well represent background groundwater concentrations of these two constituents.

RC

This site is served by a state-approved system located approximately 70 feet to very poorly drained soils and the highest observable tide. The home and septic system cover ~35% of the total area of this lot. ANOVA showed that there are significant differences between wells at this site for NO_3 and fecal coliforms ($p < 0.05$). Vertical transport of N, mostly as NH_4, below the EDA (well 4) is evident from mean DIN concentration of >12.0 mg/L measured in this well (Fig. 32A). Lateral transport of N to downgradient wells 1D and 3 is also evident from mean DIN concentrations of >10.0 mg/L measured in these wells. Vertical and lateral transport of PO_4 is apparent as wells RC 1-4 all have PO_4 concentrations >0.70 mg/L (Fig. 32B).

Vertical transport of bacteria beneath the EDA (well 4) appeared to be limited as fecal coliforms, *E. coli*, and enterococci were detected only as high as 1.0, 1.0, and 3.5 cfu/100 ml, respectively. More frequent detection of indicator bacteria was found in downgradient wells 1D and 3. Downgradient well 1D had fecal coliform, *E. coli*, and enterococci levels which ranged from 0-32, 0-26, and 0-9.2 cfu/100 ml, respectively, while each had geometric means of 2.1, 1.1, and 1.2 cfu/100 ml, respectively. Downgradient well 3 had relatively lower levels of fecal coliforms, *E. coli*, and enterococci with geometric means of 0.6, 0.6, and 1.3 cfu/100 ml, respectively. Consistent detection of fecal indicator bacteria in downgradient wells demonstrates the ability of bacteria to migrate in groundwater at relatively low levels in the vertical and lateral directions at this site.

Groundwater monitoring at this site showed that the watertable was consistently greater than 4 feet below the estimated bottom of the EDA with the exception of May, 1995 in which the watertable rose to within roughly 2 feet of the EDA bottom (Fig. 32C). Nitrate, ammonium, and phosphate fluctuated considerably below the EDA throughout the study period (Fig. 32D). Changes in concentrations of these nutrients below the EDA do not appear to correlate with watertable depth, and more likely reflect changes in loading rates and ensuing degree of treatment within the chamber system.

Denitrification does not appear to be happening as groundwater migrates from the EDA well (4) to downgradient wells 1D and 3 based on the fact that the DIN concentration does not appreciably decrease. It does appear that some nitrification may be occurring in the downgradient direction as downgradient well 3 had significantly higher levels of NO_3 (mean = 7.04 mg/L) than the EDA well (mean = 3.42 mg/L).

Inter-site Comparisons

The ranges of contaminant concentrations for all samples from all of the wells at each site are summarized in Table 10 to see if there are trends in contaminant concentrations relative to specific sites or areas. The lowest values in the concentration ranges presented are considered indicative of background levels at each site. The River St. sites had higher background levels of ammonium and much higher 'high' concentrations of phosphates compared to the in-town samples. The high phosphate levels may reflect the extreme high density of houses and septic systems on River St. and accompanying high P-loading rates, compared to the in-town sites. High ammonium levels suggest incomplete nitrification occurring in the soils of River St., possibly a result of development on relatively shallow fill soils overlying wetland soils that have more limited depths of aerobic, unsaturated soils required for nitrification.

The background nitrate levels were very low at the River St. sites and at two of the four in-town sites. These are not necessarily indicative of clean areas, rather, they may also reflect the presence of wells, often under EDAs, that have little nitrate produced relative to TDN. The two sites with highest 'background' nitrate levels are CSL and KDB, both located in relatively less dense housing areas. These also have the highest average nitrate:ammonium ratios (Table 10). These latter data indicate a high rate of nitrification relative to TDN. The River St. sites are again apparently different from the in-town sites in that their ratios are all relatively low, with most below 1.0, while in-town sites have higher ratios, most well above 1.0. Thus, much of the TDN at in-town sites has been nitrified, compared to an apparently lower conversion at sites with low ratios.

The high values in the presented concentration ranges for contaminants in Table 10 can be compared to literature values for septic tank effluent contaminant concentrations in Table 1. Bacterial contaminant concentrations never came close to estimated effluent concentrations. Orthophosphate concentrations were within the range of the estimated effluent concentrations (6-15 mg P/L) at RH, RP and RC, with concentrations ranging from 6.9 to 8.9 mg P/L. Ammonium reached concentrations nearly equal to the lower end of the estimated effluent concentration (28-90 mg N/L) at sites REH, RET, RC, CSL, WRH, and FDC, all with concentrations of 18-22 mg N/L. Nitrate is discharged with septic tank effluent at relatively low levels (Table 1). However, TDN concentrations from REH, RH, RC, CSL, WRH, KDB and FDC were >20 mg N/L on one or more occasions (Table 8). This occurred most consistently at RC and KDB. Temporal trends for all of the sites are typically quite variable (Table 8).

Surface Water Quality

Surface water samples were collected at low tide, from 16 sites throughout the study area, from June 1995 to June 1996 (Tables 11 & 12). Samples sites were located in 4 main areas: 1) the non-tidal headwaters of Mill Creek in the upper portion of the watershed, the Forest Drive area (west of Rt. 1), which included sites SSW 10, 11, and 12; 2) along Mill Creek (tidal) which traverses sites WRH and CSL and discharges into Hampton Harbor; these sites include SSW 3, 4, 5, and 7; 3) sites SSW 8 & 9 at the headwaters of a Farm Brook in the Kimberly Drive area which eventually drains into Hampton Harbor; 4) the River Street and Hampton Harbor area which includes sample sites in various harbor locations and a tidal creek. These sample sites include SSW 1, 2, 6, 13, 14, 15, and 16. Adjacent surface waters at sites WRH, KDBM, KDBS, CSL, and REH were sampled both upstream and downstream in to attempt to assess the impacts of these particular sites on surface waters.

Mean concentrations of NO_3, NH_4, and PO_4 ranged from 0.52-1.85, 0.13-0.16, and 0.01-0.04 mg/L, respectively, in surface waters in the upper portion of the watershed (SSW 10, 11, and 12; Table 11; Figure 33). The most upstream surface water site, SSW 10, had elevated levels of DIN, particularly as NO_3 (mean = 1.85 mg/L), which was significantly higher than DIN levels observed at all other sites. In general, surface water sites in the upper portion of the watershed, SSW 10, 11, and 12, contained elevated levels of NO_3 while NH_4 and PO_4 were similar to concentrations observed at other downstream surfacewater sampling locations.

Site SSW 10 also had elevated counts of fecal coliforms and *E. coli*, with geometric means equal to 270 and 100 cfu/100 ml, respectively, as compared to SSW 11 and 12 which had geometric mean levels of fecal coliforms and *E. coli*, of 36 and 32 cfu/100 ml, and, 71 and 61 cfu/100 ml, respectively (Table 12; Figure 34). Enterococci and *C. perfringens* were also detected in surface water samples from SSW 10, 11, and 12 at geometric mean levels of greater than 18 and 2 cfu/100 ml, respectively.

Mean concentrations of NO_3, NH_4, and PO_4 in surface waters samples from tidal portions of Mill Creek, SSW 3, 4, 5, and 7, ranged from 0.49-0.92, 0.09-0.16, and 0.02 to 0.06 mg/L, respectively (Fig. 33). Like the surface water samples in the upper portion of the watershed (SSW 10, 11, and 12), nitrate levels in this area were also elevated above levels typically seen in the Hampton Harbor, which average <0.10 mg/L. The surface water samples in Mill Creek, SSW 3, 4, 5, and 7, had the highest levels of fecal indicator bacteria compared to all other areas.

Geometric mean levels of fecal coliforms, *E. coli*, enterococci, and *C. perfringens* ranged from 230-620, 180-410, 44-140, and 14-79 CFU/100 ml, respectively (Fig. 34). SSW 7 had significantly higher levels of all fecal indicators than most of the Hampton Harbor sites.

Surface water samples from Farm Brook in the Kimberly Drive area also had elevated concentrations of NO_3 and PO_4 (Fig. 33). SSW 8 and 9 had mean concentrations of NO_3, NH_4 and PO_4 of 1.31, 0.21, and 0.22 mg/L, and, 1.77, 0.12, and 0.20 mg/L, respectively. The PO_4 concentration measured at these two surface water sites were significantly higher than PO_4 concentrations measured at all other surface water sampling locations. Geometric mean levels of fecal coliforms and *E. coli* in SSW 8 and 9 were 75 and 68 cfu/100 ml, and 109 and 91 cfu/100 ml, respectively. Enterococci and *C. perfringens* were detected at geometric mean levels of greater than 141 and 7 cfu/100 ml at these two locations (Fig. 34). The levels of fecal indicator bacteria detected in surface water samples from this area were relatively lower than those found in Mill Creek and the upper watershed sites yet elevated above those levels detected in Hampton Harbor.

Levels of nutrients and microbial indicators measured in surface water samples from the River St./Hampton Harbor area were generally lower than levels observed at the other surface water sampling locations (Figures 33 & 34). Mean concentrations of NO_3, NH_4, and PO_4 at SSW sites 1, 2, 6, 13, 14, 15, and 16 ranged from 0.03-0.11, 0.06-0.27, and 0.02-0.06 mg/L, respectively. Geometric mean levels of fecal coliforms, *E. coli*, enterococci, and *C. perfringens* at these same sites ranged from 2-37, 2-32, 22-25, and 2-15 cfu/100 ml, respectively.

All surface water sites showed significant levels of fecal contamination. The geometric mean limit of ≤14 fecal coliforms/100 ml for approved shellfish areas as promulgated by the National Shellfish Sanitation Program was exceeded at every site except one. The lone site where the limit was not exceeded was site SSW 16 at the mouth of Hampton Harbor. This sampling location was different in that it did not sample harbor waters or a creek, rather, it sampled overland flow which occurred at low tide on the beach on the Seabrook side of the harbor. In New Hampshire, the marine swimming/recreational waters standard is 35 enterococci/100 ml. This value was exceeded at sites 3-5 and 7-10, all located on the small tidal streams while the levels for harbor sites were <35. There was no clear connection between surface water quality and groundwater contamination at any specific site. This was evident as there were no statistically significant differences between upstream and downstream surface waters at any site for any of the measured parameters.

The greatest levels of nutrient and fecal contamination occurred in the upper portion of the watershed (Forest Drive area), along Mill Creek, and in Farm Creek near Kimberly Drive. The Kimberly Drive sites were probably affected by the high NO_3 levels found in groundwater downgradient from KDBM and KDBS. All three of these areas are characterized by relatively high density housing developments which rely entirely on septic systems for wastewater disposal. There are no other known sources of nutrient or fecal contaminants in these areas, thus it appears that the cumulative effect of these high density residential areas are responsible for the observed nutrient and microbial contamination of surface waters in these areas. Several researchers have associated fecal and nutrient contamination of surface waters with residential density (Bicki and Brown, 1990; Perkins, 1984; Duda and Cromartie, 1982; Morrill and Toler, 1973).

The harbor waters contained relatively lower levels of nutrient and microbial contaminants which probably resulted from increased dilution from tidal exchange, the harsher saline environment, and transport time of fecal microorganisms.

Soil Cores

The initial groundwater samples that were either mixed or sampled from the supernatant were of interest to locate areas where bacterial contaminants were present in the groundwater or attached to particles. The wells where bacteria were detected in these samples were not always wells where bacteria were later detected in groundwater, and included wells that were upgradient, down gradient, deep and within the EDAs, with no consistent location at the sites. The most commonly detected bacterial indicator in these samples was *C. perfringens*, which is naturally in tight association with particulate matter in soil and aquatic environments. To help bridge the gap between the infrequent detection of indicators in groundwater samples compared to the initial samples that contained some soil particulates, soil core samples were taken at selected sites to evaluate the presence and transport of fecal indicator bacteria in the subsurface. Soil cores were taken between the bottom of the EDA and the watertable to evaluate vertical transport at sites WRH and CSL in August 1995 and at sites KDBS and KDBM in October 1995. Soil cores were also taken laterally from EDA's, along transects, to evaluate horizontal transport at sites WRH and REH in November and December 1995, respectively.

Vertical Transport

At site WRH *C. perfringens* was detected at 9.0×10^3, 5.0×10^3, and 17.0×10^3 MPN/g soil at depths of 31.5, 46, and 55 inches below the ground surface (BGS), respectively (Table 13). The lower two depths were frequently saturated with groundwater, i.e., the water table was shallower (Figure 24C). Fecal coliforms were not detected in soil samples at any depth at this site. At site CSL, fecal coliforms, *E. coli*, and *C. perfringens* were detected at 400, 400, and 7,000 MPN/g soil at a depth of 35 inches BGS (Table 13), a depth frequently saturated with groundwater (Figure 25C). Only *C. perfringens* was detected at a depth of 43 inches BGS and only then at much lower levels, < 5.0 MPN/g soil.

At site KDBS fecal coliforms and *E. coli* were detected at equal concentrations of 800 and 20 MPN/g soil at depths of 29 and 55 inches BGS (Table 13), respectively, compared to typical water table depths of >60" BGS (Figure 26D). No fecal coliforms were detected at 42 inches below the ground surface. *C. perfringens* was detected at 29, 42, and 55 inches BGS at levels of 13.0×10^3, 13.0×10^3, and 17.0×10^3 MPN/ g soil. At site KDBM no fecal coliforms were detected in soil samples taken 33 and 44 inches BGS (Table 13), consistent with the observed deep water table (Figure 26C). However, fecal coliforms and *E. coli* were both detected at equal concentrations of 20 MPN/g soil at a depth of 59 inches below the ground surface. *C. perfringens* decreased with depth at site KDBM as levels fell from 50.0×10^3 to 9.0×10^3 to 2.2×10^3 MPN/g soil at depths of 33, 44, and 59 inches, respectively.

In summary, fecal coliforms and *E. coli* were detected in soil samples at shallow depths, <35 inches BGS, at sites CSL and KDBS at levels >400 MPN/g soil. Fecal coliforms and *E. coli* were also detected at greater depths (>55 inches BGS) at sites KDBS and KDBM at much lower levels, 20 MPN/g soil. In general, it appears that fecal coliforms and *E. coli* may be transported vertically at high concentrations to shallow soils, decreasing to extinction in deeper soils (>29-35 inches BGS) as a result of the treatment processes characteristic of soils and as intended by design of the system. The presence of fecal coliforms at deeper soil depths (>55 inches), despite not being detected at shallower depths, may result from preferential flow through macropores and root channels, or via lateral flow from other areas. The relatively high levels of *C. perfringens* detected at all depths at the various sites reflects survival of cumulative, historical contamination of the subsurface by sewage-borne bacteria.

Horizontal Transport

Soil core samples were taken along transects at sites WRH and REH. At site WRH, samples were taken upgradient from the EDA (control), within the EDA (EDA), and at distances of 1, 3, 9, and 27 feet along a transect downgradient of the EDA edge. Three transects were taken at site REH since groundwater monitoring revealed that groundwater moved in several directions at this site. No EDA core was or could be taken at site REH, and samples along each transect were taken at 1, 3, and 9 feet from the edge of the EDA. At both sites, soil core samples were taken from the top foot of the watertable, which was determined by measuring the watertable depth in the nearest well, and then using a posthole digger to excavate down to the watertable. Once free water was reached, the top foot of the watertable was sampled using a split-spoon soil corer.

The results of the soil core transect at site WRH clearly show that *C. perfringens* is present at high levels (>1 x 10^4 MPN/g soil) below the EDA and in all downgradient samples (Figure 35). *C. perfringens* levels in EDA and downgradient samples are 1-3 orders of magnitude greater than levels observed in the control sample. The presence of long-lived *C. perfringens* at high levels, even as far as 27 feet from the EDA, suggests previous sewage-borne contamination of the subsurface. The presence of fecal coliforms and *E. coli* below the EDA and at 3 and 27 feet downgradient show more recent contamination and suggest significant horizontal transport of all types of indicators. There was no observable trend in levels of *C. perfringens* with distance away from the EDA while fecal coliforms and *E. coli* both decreased significantly with distance.

The soil core transects at site REH also showed long-term contamination as evident by the presence of high levels of *C. perfringens* in soil samples which ranged from 1 x 10^4 to nearly 1 x 10^6 MPN/g soil (Figure 36). There was no clear trend in level of *C. perfringens* with distance from the EDA along any transect. No fecal coliforms were detected in any of the soil samples at this site. Thus, *C. perfringens* is similar to nitrate in that it is a conservative tracer of fecal contamination from septic systems. It differs in being more long-lasting, so that it gives a stronger temporal context, along with a spatial context, for determining if fecal contamination has occurred in the subsurface environment at distances away from septic systems and toward surface waters.

Septic System Design: 36" Compared to 48" Depth Below The EDA to ESHWT

Four sites, where the bottom of the EDA could be determined from soil coring and where actual functioning systems were know to exist, were analyzed to evaluate the effects of vertical separation between the bottom of the EDA and the watertable on microbiological groundwater quality. These four sites were WRH, CSL, KDBM, and KDBS.

At site WRH groundwater elevations plotted over the sampling period show that the watertable fell from approximately 1.25 to 3.0 feet below the bottom of the EDA from March to August 1995 (Figure 24C). A sharp rise in the watertable to the bottom of the EDA occurred in November, 1995 and fluctuated within roughly one foot below the bottom of the EDA thereafter. Groundwater elevations at site CSL show that the watertable fell from approximately 0.5 to 2 feet below the bottom the EDA from February to August, 1995 (Figure 25C). The watertable rose sharply after August, 1995 and peaked at approximately 1 foot above the bottom of the EDA in February, 1996 and then gradually decreased to roughly 1 foot below the bottom of the EDA in June, 1996. At site KDBM groundwater elevations slowly dropped from approximately 3 to 5.5 feet below the bottom of the EDA from March to August, 1995 (Figure 26C). After August, 1995 the watertable rose sharply to roughly 3 feet below the EDA in February, 1996 and then slowly dropped to 3.5 feet below the EDA in May 1996. The watertable depth below the EDA at this site remained at about 4 feet below the bottom of EDA from March to May, 1995 and then dropped to approximately 6.5 feet below the EDA in August, 1995. The watertable increased after August, 1995 to roughly 3 feet below the bottom of the EDA in February, 1996 and then gradually decreased to 4 feet below the EDA in May, 1996. Thus, no site has a high water table depth (HWT) that is >48", which occurred on only two occasions at the four sites, and all sites were installed at less than the required 48" above HWT. The data only allow evaluation of the relative degree of treatment when HWT is >36" or <36".

Microbiological data from the EDA wells (WRH-1, 2, and 5; CSL-4; KDBM-3, and KDBS-4) were grouped according to watertable depths at the time of sampling (Table 14). Groupings, based on depth of the watertable below the bottom of the EDA were as follows: <36", ≥36" but <48", and ≥48". The ≥48" category contained only two samples while the <36" and ≥36" but <48" categories had 28 and 11 samples, respectively. None of the indicators were detected (ND= not detected) in samples in the >48" category. As previously described, *C. perfringens* behaves differently than the other indicators. The *C. perfringens* data for this study further illustrate this point and should be separately discussed. For the other indicators in the 36-

48" category, bacteria were detected only in two of eleven samples, ranging from ND-75/100 ml. Conversely, indicators in the <36" category were detected in 20 of 28 samples. The indicator concentrations ranged up to 2130, 500 and 8100/100 ml for FC, Ec and enterococci, respectively. Thus, levels of all indicators were highest in the <36" depth, with much lower levels in the range of >36" but <48", and lowest for the water table at >48" below EDAs. ANOVA was conducted to evaluate different treatments (watertable depth groupings) by fecal indicator bacteria (fecal coliforms, *E. coli*, enterococci, and *C. perfringens*) measured in well samples (Table 14). ND data were given values ranging from 0.24-4.9/100 ml, depending on the detection limit which was a function of sample water volume analyzed (Table 14). All data were rank-transformed. ANOVA showed that there were no statistical differences between any of the 3 watertable depth categories and levels of *E. coli*, enterococci, and *C. perfringens* found in well samples taken at those depths. However, there was a significant difference in geometric mean fecal coliform levels at <36" compared to 36-48". Despite some of the other large differences in mean values for indicators, the data were variable enough that statistical differences were typically not seen.

The higher frequency of detection and higher concentrations observed for samples collected when the groundwater was <36" below the EDA illustrate the need for adequate depth between the EDA bed and groundwater table. The low frequency and typically low concentrations of bacteria detected when the water table was >36" suggests that this depth may be adequate for treating septage. However, the sample on 3/7/95 had elevated bacterial levels and is of concern. On that date, the water table was just barely >36", and other wells at the site had much more elevated water table depths (Figure 26C). Recognizing that water depths were measured only when samples were taken and that continuous measurements would be needed to determine how high the watertable got to during that time period, it is conceivable that the water table could have been higher, even <36" below the EDA, just before the sample was taken on 3/7/95, and that the elevated bacterial levels could have reflected those conditions. Evidence that may support this are the elevated water tables at the other wells at that site on that date (Figure 26C), and the fact that 0.7" of rain fell (Durham rainfall data) within a 48 hour time period only 7 days before at a time when spring snowmelt was just beginning. The day before, on 3/6/95, another 0.21" rain fell. During this time, temperatures were rising above freezing, suggesting that substantial rainfall and snowmelt could have been affecting water table depths at that time. Thus, the elevated levels on that date could have reflected higher water table conditions. Without confirmation of this, our results suggest that a 36" distance between the water table and the bottom of the EDA may lead to, albeit infrequent, bacterial contamination of groundwater. There are no standards by which to judge how frequent and at what levels groundwater contamination is a problem, but assuming no contamination is desirable, then 36" is not adequate.

One important question is how the findings of this study will relate to how septic systems are designed and installed. If ESHWT is based on mottling, as discussed in Section XX, then an underestimation of actual HWT is incorporated into the vertical placement of the system. The KDBM and KDBS sites are probably good examples of well-designed sites that actually had HWT at ~ 36", and not the design-required 48". Both of these systems worked quite well, especially compared to the systems with higher HWT. Further work is needed on systems that have HWT levels 36-48" and >48" below EDAs to determine what level of treatment/contamination occurs with distances. The data would then need evaluation based on defined criteria on what level of contamination frequency and concentration are 'acceptable'. Then rules on depths below EDAs to HWT, along with how to assess ESHWT, can be accurately defined.

DISCUSSION

The organization of the following discussion of the results will be according to the important questions for which the study was designed to address. These are as follows:

1.) Are contaminants from septic systems leaching into the groundwater and contaminating surrounding surface waters?

2.) Is there evidence of transformations and treatment processes that reduce groundwater pollution below any effluent disposal areas, and what are those environmental and system conditions?

3.) What is the distance between the bottom of the EDA and the seasonal high-water table that is necessary for adequate contaminant treatment?

The first question relates to whether contaminants are leaching into the groundwater. To address this, the results were evaluated to determine what evidence there was of vertical transport of both bacteria and nutrients from the bottoms of EDAs to the water table. Data on nutrient and bacterial concentrations and incidence for groundwater wells under and around EDAs, lysimeter data for unsaturated areas under EDAs, and groundwater table depths were analyzed. The study sites had a whole range of types of systems, including one well-designed system, three other actual drainage fields, one chamber system and the rest are make-shift systems or non-systems. It is important to know how deep the groundwater table/level is because saturated conditions are not conducive to treatment of contaminants. The groundwater conditions observed included some sites where groundwater inundates the EDA on a regular basis, other systems where occasional inundation occurred, and others where the water table was always well below the bottom of the EDA. Some of the latter sites have make-shift systems, and only one site had a definable EDA that was without a high water table.

The results relative to vertical, or gravity-driven, transport of contaminants to the groundwater showed some trends. Generally, evidence of vertical contaminant transport in wells below EDAs was based on the elevated concentrations observed relative to the background concentrations in the upgradient wells. The greater the distance between the bottom of the EDA to the water table, the smaller the impact to the groundwater quality, i.e., the lower the contaminant concentrations in groundwater. Phosphate is less likely to reach the groundwater compared to nitrogen species, as it reacts with soil. Ammonium also reacts with soil, while nitrate, which does not adsorb to soil, is most readily leached to the groundwater. The contaminants tended to be present in soil water at relatively high levels where unsaturated zones existed, slowly leaching into groundwater or more rapidly upon inundation with rising water tables. Bacteria were also found at consistent and relatively high concentrations below EDAs, especially in areas where salt water influence was minimal. For both nutrients and bacteria, contaminants did not appear to be transported to deeper groundwater. It appears that the contaminants vertically transported to the top of the groundwater tended to accumulate there and did not continue to be transported in significant quantities to deeper groundwater levels. Thus, contaminants do leach into the groundwater below EDAs and accumulate at the top of the water table.

The next question is whether contaminants are laterally transported to surface waters. This is more tricky to address compared to the first question, where wells located in defined areas (below EDAs) can be studied. In contrast, to determine if contaminants are transported to surface waters, wells need to be located for sampling where they will intercept the effluent plume in the groundwater. Detailed information like hydraulic conductivity and long-term monitoring of groundwater flow were determined during the study, and it was not available for helping to site wells when test wells were initially installed. A positive result is easily interpreted, a negative result begs the question of whether the plume was missed. The elevated levels of nutrients and bacteria found in the surface waters around Seabrook suggest that sources of fecal contamination exist. There are no other apparent sources in the mostly residential study area other than the houses and their septic systems. Thus, septic systems were suspected to be the main source of contamination.

The soils in the study areas around the EDAs are generally fine-grained sands. Sandy soils tend to have little structure, and wells in this matrix tend to accumulate sand particles. Because of this, water samples collected from the wells typically had substantial amounts of suspended sand. In initial samples, the amount of sand was inconsistent, even though we found that a majority of bacteria detected in the samples were attached to the particles. To help standardize the sampling procedure, to make nutrient analyses possible, and to give more consistent and quantitative (albeit, more conservative) estimates of bacterial concentrations, the eventual sampling procedure incorporated a prefiltration step to remove particles. The reasoning was that the concern was not really to determine the presence of bacteria in the wells, rather, the concern was their transport to surface waters. As such, the cells that were not attached to particles were suspected to be those that were being transported in the groundwater. Thus, the data reflect findings for free-living bacterial cells, and are quite conservative estimates of groundwater contamination levels, probably 10-1000x lower than the total cells. This, coupled with the difficult task of locating bacterial effluent plumes, made it difficult to measure bacterial contaminants in groundwater.

The concentrations of bacteria in water samples from wells around the EDA were substantially lower than those from below the EDA. This implied that the bacteria were being reduced in concentration as they were transported laterally away from the EDA. The possible mechanisms for this include impingement within small pores in the soil matrix, die-off, adsorption to surfaces, and dilution. We observed inconsistent detection and low concentrations of bacteria in wells at distances >1 meter away from the EDAs, including new wells located off the residential properties closer to surface waters. The exception was a site on River St., where determining the location of actual EDAs was a challenge. One striking observation was the low concentrations of *C. perfringens*, a common fecal contaminant that tends to stick to particles, as observed in initial samples that included particulate matter. This conservative approach to sample processing was probably not allowing detection of bacteria at reduced concentrations in groundwater at distances from the EDA. Soil cores were collected at two sites at depths above and below the water table to determine if the bacteria were actually attached to particles, especially at this interface between saturated and unsaturated soil (the water table). The results of that study showed high levels of *C. perfringens* in all samples, with evidence of transport of fecal coliforms and enterococci at relatively long distances as well. This confirmed that fecal-borne bacteria from septic systems were being transported away from septic systems toward surface waters at relatively long (9 meters) distances and at significant concentrations.

The strongest evidence that contaminants from septic systems were being transported laterally away from septic systems was the relatively high levels of nitrate detected in some distant wells. Relatively high levels of nitrate were detected in wells as far as 20 meters from the edge of the EDAs. Thus, elevated levels of nitrate were evidence that part of the effluent plume in the subsurface had been detected because not all downgradient wells had elevated nitrate levels, and were therefore out of the plume. Phosphate was also apparently transported away from EDAs in the River St. area where the high density of houses and EDAs probably have lead to saturation of phosphate in the relatively non-reactive sandy subsurface soils. An observation made at River St. was that groundwater flow changed directions throughout the year, and sometimes daily, resulting in the smearing of nutrients in groundwater wells supposedly located in both upgradient and downgradient directions. In lower density areas, phosphorus was not laterally transported.

Use of the MPN method for enumerating fecal indicators in samples that were not prefiltered are a less conservative reflection of bacterial presence in the different wells sampled. In fact, bacteria were almost always detected, and at higher than background levels, in samples collected from wells and not prefiltered. Because the bacteria are not freely suspended in the water, this evidence reflects either recent or historical transport to the subsurface area around all of the wells. Saltwater tends to enhance the adsorption of bacterial cells to surfaces, so wells at sites affected by saltwater had even less bacteria detected in prefiltered water (example: REH).

The adsorption of bacteria to soils surfaces is just one complication in explaining the field observations related transport of bacteria through the subsurface environment to surface water. The subsurface environment is quite complex both spatially and temporally. The transport of bacteria through the pore spaces of the unsaturated and saturated soil matrices is a tortuous process. Pores of different diameters affect both the transport velocity and the degree of interaction between cells and surfaces. The degree of saturation with water affects the amount of available water for bacteria to become suspended within and the depth of water films on surfaces of unsaturated soils affects motility and survival. As water moves through the soil matrix, the suspended bacterial contaminant concentrations will change as cells become dispersed into pores. Groundwater moves at slow rates and will laterally disperse cells. Seasonal environmental and tidal factors and wastewater loading rates to septic systems can affect the vertical movement of water over time as well. As water tables drop, cells may be left behind in upper horizons of the soil that become unsaturated and potentially less conducive to survival. When water tables rise, bacterial cells typically in the surface film will be forced through pores into upper horizons, while others may be left behind in deeper groundwater conditions. All of these different subsurface conditions relative to groundwater depth can affect the survival of indicator and pathogenic bacteria, and the time spent under unfavorable or favorable conditions will determine the degree of bacterial die-off. Factor in varying conditions in loading, seasonal environmental conditions, variable and changing conditions in septic system drainage beds, tidal effects on groundwater flow, discontinuous hydraulic conductivity properties, and a myriad of other factors, and the explanations for field observations, especially the infrequent detection and low numbers of bacteria in wells downgradient from EDAs, become difficult. Thus, the fact that any samples showed bacteria in downgradient wells should be considered significant and evidence supporting the contamination of surface water via groundwater flow from septic systems.

The use of *C. perfringens* as a bacterial indicator of fecal-borne microbial contaminants in groundwater is a useful tool for determining if and where contamination has occurred. It is similar to nitrate because it can be considered a conservative tracer, i.e., relatively non-transformed, in the subsurface. Its long-term existence makes it conservative in a temporal context, while the non-reactivity of nitrate with soil particles makes it conservative on a spatial scale. The puzzlement that results from inconsistent results, as described above, where surface water contamination levels are higher than groundwater levels of bacteria around septic systems, can be counter-acted by considering the *C. perfringens* data. Generally, high levels were detected in subsurface locations that have been exposed to laterally-transported microbial contamination. Use of fecal coliforms, enterococci, or other nonspore-forming bacteria as sole indicators in this study could have lead to incorrect conclusions about the transport of bacterial contaminants. Use of the four different indicators in this study allowed for multi-dimensional interpretation of results. In particular, the observed high values of *C. perfringens* at distances downgradient from EDAs increases the significance of the less frequent and lower concentrations of the other indicators.

The results showed evidence of transformations of nutrients and bacteria in the subsurface environment below the EDAs. The greater the distance below the EDA to the water table, the greater extent of nitrification was evident. In sites where the water table was high, ammonium was much more commonly measured at high concentrations, while nitrate became essentially the sole nitrogen contaminant in wells that included deeper unsaturated layers below the EDAs. In soils with high seasonal high water tables, ammonium may be transported to groundwater, but appears to be rapidly changed to nitrate in wells away from the EDA. There appeared to be some evidence of denitrification occurring in the higher/shallower levels of the groundwater near to some EDAs, as the total dissolved inorganic nitrogen (DIN=ammonium, nitrite, nitrate) concentrations were substantially decreased compared to EDA wells. Ammonium that was leached into the upper groundwater levels was apparently nitrified, as little ammonium was measured in paired deeper wells. In unsaturated zones, DIN concentrations were not reduced while much of the ammonium was nitrified. When the water table was high enough to inundate the bottoms of EDAs, ammonium accumulated in the groundwater. Eventually, it appeared that the nitrifying bacteria adapted to new conditions and nitrification resumed under these conditions.

Phosphate is not typically transformed under conditions found in this study, and bacterial die-off was not investigated. However, it was obvious from the results that both contaminants were transformed in the sense that both were attenuated by the soil matrix when the water table was not too high.

The depth below an EDA to seasonal high groundwater is a question that needs more work. It appears that bacteria were found in groundwater rarely and at low concentrations at two sites where the seasonal high water table was < 36" below the EDA only once out of 24 samplings. Other sites, where the seasonal high water table was typically < 36' below the EDA had more frequent incidence and higher concentrations of bacteria. As described above, nitrification may not occur in soils below EDAs when the groundwater level is too high. Preliminary interpretation of results appears to support the possibility using a shallower depth (36-48") than the presently required depth of 48' below the bottom of an EDA to the top of the water table. The final interpretation of the results relative to this question is based on only a few sites, and further studies on this question under a wider range of soil conditions may be required to adequately answer this question.

CONCLUSIONS

The sites selected for study were not uniform in anyway that would facilitate a systematic, scientific assessment of factors associated with the effectiveness of subsurface sewage treatment. However, the selected sites probably are a reasonable reflection of actual systems in older coastal developed areas. It is unfortunate that a wider range of soil types could not be included in this study. However, again, the sites selected were limited to sites within Seabrook and in close proximity to tidal or tributary surface waters, thus excluding many areas that could represent a wider range of coastal New Hampshire soils. In the final analysis, it is amazing to find so many willing participants for such a study.

Despite the observed changes in groundwater flow direction that complicated the location of distinct contaminant plumes at some sites, it is apparent that most of the study sites have relatively contaminated groundwater. Even RB, which has not been occupied for a few years so that the EDA has not been used, has elevated levels of phosphate in groundwater, even out near the marsh edge. The contaminated groundwater appears to have some impact on adjacent surface waters, especially in high density housing areas. The areas of highest housing density are the River St. sites and FDC, which is at the edge of an older high density housing development. In addition, WRH is located next to and downgradient from an elementary school on septic systems and numerous other houses, while KDB is at the end of a new development with a relatively high density of houses and associated mounded effluent disposal areas. All of these sites are in close proximity to surface waters, and the loading rate of nutrients, especially nitrate, measured in wells probably exceeds the capacities of the remaining or nonexistent riparian zones to effectively treat contaminants.

The bacterial contaminants were not transported away from EDAs consistently or in high quantities. Bacteria are not as mobile as nitrate, and are probably more tightly associated with soil particles. However, in soil core and initial groundwater samples that included some particulate matter, fecal-borne bacteria were detected in wells away from EDAs at high concentrations, evidence of recent or historical transport to those areas by some mechanism. The method adopted for routine sampling of wellwater for bacteria is a conservative approach that excludes most particle-associated bacteria.

REFERENCES

Alhajjar, B. J., Harkin, J. M., and Gordon Chesters, 1989, Detergent Formula and Characteristics of Wastewater in Septic Tanks, *J. Wat. Poll. Cont. Fed.*, 61:5:605-613.

Bicki, T. J., R. B. Brown, M. E. Collings, R. S. Mansell and D. F. Rothwell, 1984, Impact of On-site Sewage Disposal Systems on Surface and Ground Water Quality. Report LC170, Florida Dept. of Health and Rehabilitative Services, Tallahassee, Fla.

Brandes, M., 1978, Characteristics of Effluents from Gray and Black Water Septic Tanks, *J. Water Poll. Control Fed.*, 50:2547-2559.

Brooks, D., and Irina Cech, 1979, Nitrates and Bacterial Distribution in Rural Domestic Water Supplies, *Wat. Res.*, 13:33-41.

Brown, K. W., Wolf, H. W., Donnelly, K. C., and J, F. Slowey, 1979, The Movement of Fecal Coliforms and Coliphages below Septic Lines, *J. Env. Qual.*, 8:1:121-125.

Brown, K. W., Donnelly, K. C., Thomas, J. C., and J. F. Slowey, 1984, The Movement of Nitrogen Species Through Three Soils Below Septic Fields, *J. Environ. Qual.*, 13:3:460-465.

Canter, L. W., and Knox, R., 1985, Septic Tank System Effects on Ground Water Quality, Lewis Publishers, Inc., Chelsea, Michigan.

Chen, M., 1988, Pollution of Ground Water by Nutrients and Fecal Coliforms from Lakeshore Septic Tank Systems, *Water, Air, and Soil Poll.*, 37:407-417.

Clark, E. H., Haverkamp, H. H., and W. Chapman, 1985, Eroding Soils: The Off-Farm Impacts, The Conservation Foundation, Washington, DC.

Cogger, C., and B. L. Carlile, 1984, Field Performance of Conventional and Alternative Septic Systems in Wet Soils, *J. Environ. Qual.*, 13:1:137- 142.

Cogger, C., 1988, On-site Septic Systems: The Risk of Groundwater Contamination, *J. of Env. Health*, 51:1:12-16.

Cogger, C., Hajjar, L. M., Moe, C. L., and M. D. Sobsey, 1988, Septic System Performance on a Coastal Barrier Island, *J. Environ. Qual.*, 17:3:401-408.

Craun, G. F., 1985, A Summary of Waterborne Illness Transmitted through Contaminated Groundwater, *J. Environ. Health*, 48:3:122-127.

Davies, C.M., J.A.H. Long, M. Donald and N.J. Ashbolt. 19995. Survival of fecal microorganisms in marine and freshwater sediments. Appl. Environ. Microbiol. 61: 1888-1896.

Duda, A. M., and K. D. Cromartie, 1982, Coastal Pollution from Septic Tank Drainfields, *J. Env. Eng. Div.*, 108:1265-1279.

Gonzalez, J.M., J. Iriberri, L. Egea and I. Barcina. 1992. Characterization of culturability, protistan grazing, and death of enteric bacteria in aquatic ecosystems. Appl. Environ. Microbiol. 58: 998-1004.

Hagedorn, C., Hansen, D. T., and G. H. Simonson, 1978, Survival and Movement of Fecal Indicator Bacteria in Soil under Conditions of Saturated Flow, *J. Environ. Qual.*, 7:1:55-59.

Hagedorn, C., MCCoy, E. L., and T. M. Rahe, 1981, The Potential for Ground Water Contamination from Septic Effluents, *J. Environ. Qual.*, 10:1:1-8.

Hileman, B., 1990, Alternative Agriculture, *Chem. and Eng. News*, 68:26-40.

Hill, D. E. and B. L. Sawhney, 1981, Removal of Phosphorus from Waste Water by Soil Under Aerobic and Anaerobic Conditions, *J. Environ. Quality*, 10:3:401-405.

Hvorslev, M. J., 1951, Time lag and soil permeability in groundwater observations, U.S. Army Corps Engrs. Waterways Exp. Sta. Bull. 36, Vicksburg, Miss.

Jones, R. A., and G. F. Lee, 1979, Septic Tank Wastewater Disposal Systems as Phosphorus Sources for Surface Waters, *J. Water Poll. Control Fed.*, 51:2764-277

Jowett, E. C., and Michaye L. McMaster, 1995, On-Site Wastewater Treatment Using Unsaturated Absorbent Biofilters, *J. Env. Quality*, 24:86-95.

Laak, R., 1974, Relative pollution strengths of undiluted waste materials discharged in households and the dilution water used for each. In J. H. T. Winneberger, ed., *Manual of Greywater Treatment Practice*. Ann Arbor Science, Ann Arbor, MI, pp.68-78.

Lapointe, B. E., O'Connell, J. D., and George S. Garrett, 1990, Nutrient couplings between on-site sewage disposal systems, groundwaters, and nearshore surface waters of the Florida Keys, *Biogeochemistry*, 10:289-307.

Magdoff, F. R., D. R. Keeney, J. Bouma, and W. A. Ziebell, 1974, Columns representing mound-type disposal systems for septic tank effluent: II. Nutrient transformations and bacterial populations. *J. Environ. Qual.* 3:228-234

Mathsoft, Inc., 1994, ADEPT (A Program for Aquifer Data Evaluation) for the Mathcad® environment, C.H.E.S.S. Inc., Bethesda, MD.

Morrill III, G. B, and L. G. Toler, 1973, Effect of Septic-Tank Wastes on Quality of Water, Ipswich and Shawsheen River Basins, Massachusetts, *J. Research U.S. Geol. Survey*, 1:1:117-120.

Netter, R., Stubner, E., Wilder, P. A., and Ivan Sekoulov, 1993, Treatment of Septic Effluent in a Subsurface Biofilter, *Wat. Sci. Tech.*, 28:10:117-124.

New Hampshire Estuaries Project (NHEP), March 1995, Governer's Nomination to the National Estuary Program, p2-31.

New Hampshire Fish and Game Department (NHFGD), Marine Fisheries Division, 1991, Coastal Shellfish and Water Quality Progress Report, p16.

New Hampshire Department of Environmental Services (NHDES). 1995. Coastal Watershed Status report. New Hampshire Department of Environmental Services, Concord, NH.

New Hampshire Department of Environmental Services (NHDES). 1994. Preliminary report on research needs. Presented to the University of New Hampshire, March, 1994. New Hampshire Department of Environmental Services, Concord, NH.

Paul, J. H., Rose, J. B., Jiang, S., Kellogg, C., and Eugene A. Shinn, 1995, Occurence of Fecal Indicator Bacteria in Surface Waters and the Subsurface Aquifer in Key Largo, Florida, *Applied and Env. Microbiol.*, 61:6:2235-2241.

Pommepuy, M., J.F. Guillaud, E. Dupray, A. Derrien, F. LeGuyader and M. Cormier. 1992. Enteric bacteria survival factors. Wat. Sci. Tech. 25: 93-103.

Postma, F. B., Gold, A. J., and George W. Loomis, 1992, Nutrient and Microbial Movement from Seasonally-Used Septic Systems, *J. Environ. Health*, 55:2:5-10.

Reneua, R. B. Jr., and D. E. Pettry, 1975, Movement of Coliform Bacteria from Septic Tank Effluent through Selected Coastal Plain Soils of Virginia, *J. Environ. Qual.*, 4:1:41-44.

Reneua, R. B. Jr., and D. E. Pettry, 1976, Phosphorus Distribution from Septic Tank Effluent in Coastal Plain Soils, *J. Envirn. Qual*, 5:1:34-39.

Reneua, R. B. Jr., Hagedorn, C., and M. J. Degen, 1989, Fate and Transport of Biological and Inorganic Contaminants from On-Site Disposal of Domestic Wastewater, *J. Environ. Qual.*, 18:135-144.

Robertson, W. D., Cherry, J. A., and E. A. Sudicky, 1991, Ground-Water Contamination from Two Small Septic Systems on Sand Aquifers, *Ground Water*, 29:1:82-92.

Shiaris, M.P., A.C.Rex, G.W. Pettibone, K. Keay, P. McManus, M.A. Rex, J. Ebersole and E. Gallagher. 1992. Distribution of indicator bacteria and *Vibrio parahaemolyticus* in sewage-polluted intertidal sediments. Appl. Environ. Microbiol. 53: 1756-1761.

Small Flows Journal, 1996, Census shows onsite systems are here to stay, 10:1:4.

Solic, M. and N. Krstulovic. 1992. Separate and combined effects of solar radiation, temperature, salinity and pH on the survival of faecal coliforms in seawater. Mar. Pollut. Bull. 24: 411-416.

Sorensen, S.J. 1991. Survival of *Escherichia coli* K12 in seawater. FEMS Microbiol. Ecol. 85: 161-168.

Stewart, L. W., and R. B. Renuea, Jr., 1981, Spatial and Temporal Variation of Fecal Coliform Movement Surrounding Septic Tank-Soil Absorption Systems in Two Atlantic Coastal

Plain Soils, *J. Environ. Qual.*, 10:4:528-531.

Tchobanoglous, G., F. L. Burton, and Metcalf and Eddy, Inc. 1991. Wastewater Engineering: Treatment, Disposal, and Reuse. McGraw-Hill Book Co., Inc., New York, N. Y. 1334 pp.

U.S. Environmental Protection Agency (USEPA). 1991. Buzzards Bay Comprehensive Conservation and Management Plan, Volume 1: Management Recommendations and Action Plans. USEPA, Washington, DC.

USEPA, 1986, Septic Systems and Ground-Water Pollution: A Manager's Guide and Reference Book, Office of Groundwater Protection, Washington, DC 20460.

USEPA, 1984, North Carolina barrier islands wastewater management. Environmental Impact Statement 904/9-84-117. USEPA, Atlanta, GA.

USEPA, 1977, Alternatives for small wastewater treatment systems, USEPA Rep. 625/4-77-011, USEPA, Washington, D. C..

Wilhelm, S. R., Schiff, S. L., and John A. Cherry, 1994, Biogeochemical Evolution of Domestic Waste Water in Septic Systems: 1. Conceptual Model, *Ground Water,* 32:6:905-916.

TABLE 1

TYPICAL VALUES OF NUTRIENT AND MICROBIAL CONSTITUENTS IN SEPTIC TANK EFFLUENT AS REPORTED IN THE LITERATURE

CONTAMINANT	MEAN CONCENTRATION	AUTHOR
Total-N (mg/L)	29.8	Brown et al., 1984
	40	Canter and Knox, 1985
	101	Postma et al., 1992
NH4-N (mg/L)	59	Alhajjar et al., 1989
	30	Canter and Knox, 1985
	28	Cogger et al., 1988
	51.2	Jowett and McMaster, 1995
	60-90	Netter, 1993
	30-59	Robertson et al., 1991
NO3-N (mg/L)	0.2	Alhajjar et al., 1989
	0.22	Brandes, 1978
	<0.5	Cogger et al., 1988
	0.1-1.0	Robertson et al., 1991
Total-P (mg/L)	14	Alhajjar et al., 1989
	18.6	Brandes, 1978
	15	Canter and Knox, 1985
	8.0-12.0	Netter, 1993
	13	Postma et al., 1992
PO4-P (mg/L)	11	Alhajjar et al., 1989
	15.2	Brandes, 1978
	6.2	Cogger et al., 1988
	5.5-11.0	Reneau and Pettry, 1976
	8.0-13.0	Robertson et al., 1991
total coliforms (#/100 ml)	3.00E+08	Alhajjar et al., 1989
	2.60E+06	Brandes, 1978
	6.40E+06	Jowett and McMaster, 1995
	1.10E+07	Reneau and Pettry, 1975
fecal coliforms (#/100 ml)	2.10E+07	Alhajjar et al., 1989
	1.08E+06	Brandes, 1978
	1.11E+06	Brown et al., 1979
	4.20E+05	Hagedorn et al., 1981
	1.80E+06	Jowett and McMaster, 1995
	1.30E+06	Reneau and Pettry, 1975

TABLE 2: SEABROOK STUDY SITES: SYSTEM CHARACTERISTICS.

SITE	SYSTEM AGE	STATE APPROVED	# OF OCCUPANTS	SYSTEM IN FILL OR NATURAL SOIL	DEPTH TO MOTTLING	DOWN GRADIENT TOPOGRAPHY
	Adjacent to tidal marshes or beach: River Street					
REH	10+	No	1	In Fill	20"	marsh/creek
RET	2+	No	2	In Fill	20"	marsh
RB	30+	No	1 to 2	Nat. Soil	17"	marsh
RH	5	?	2	Nat. Soil	•	beach
RP	40+	No	1	Nat. Soil	•	beach
RC	8+	Yes	2 to 3	Fill/Raised	•	beach
	Adjacent to tidal marshes: In Town					
WRH	7	No	2	Fill/Raised	28"	marsh
CSL	37	No	1	Nat. Soil	30"	marsh
KDBS	7	Yes	4	Fill/Raised	26"	marsh
KDBM	7	Yes	4 to 5	Fill/Raised	26"	marsh

TABLE 3: Soils and subsurface characteristics of study sites.

SITE	SLOPE of EDA	DISTANCE to POORLY DRAINED SOILS from EDA	LIMITATIONS of SOILS for SEPTIC SYSTEMS	DEPTH TO TRENCH BOTTOM (BGS)	RANGE IN H20 TABLE DEPTH (BGS)	RANGE IN SALINITY (BGS)
		Adjacent to tidal marshes or beach: River Street				
REH	0-3%	10' to very poorly	SEVERE	undetermined	0.82-2.44'	0-20.5
RET	0-3%	75' to poorly	undefined	undetermined	0.0-4.77'	0-4.0
RB	0-3%	30' to very poorly	SEVERE	undetermined	3.06-4.65'	3.8-31.0
RH	0-3%/8-15%	85' to very poorly	undefined	undetermined	6.41-7.55'	2.0-20.5
RP	0-3%/8-15%	90' to very poorly	undefined	undetermined	6.75-7.98'	3.0-21.0
RC	0-3%/8-15%	70' to very poorly	undefined	undetermined	4.30-7.52'	2.0-28.0
		Adjacent to tidal marshes: In Town				
WRH	0-3%/3-8%	50' to poorly	undefined	2.42' (29")	3.0-4.64'	0-0.3
CSL	0-3%	60' to poorly	SEVERE	2.17' (26")	1.95-5.14'	0-0.9
KDBS	25-35%/0-3%	100' to poorly	SEVERE	2.5' (30")	5.57-8.4'	0-0.8
KDBM	25-35%/0-3%	100' to poorly	SEVERE	2.08' (25")	5.73-8.47'	0-0.5

BGS: defined as "below ground surface".
ppt: defined as "parts per thousand".
undefined: indicates soils where limitations were not defined by county soil survey.
undetermined: indicates sites where EDA could not be cored to determine depth to trench bottom.

TABLE 4: SEABROOK STUDY SITES: SUBSURFACE CHARACTERISTICS.

SITE	EDA SOIL SYMBOL	SEPTIC SYSTEM LIMITATIONS	SLOPE	DOWN GRADIENT SOIL	SEPTIC SYSTEM LIMITATIONS	SLOPE	DISTANCE to POORLY DRAINED SOILS from EDA
	Adjacent to tidal marsh or beach: River Street						
RBH	100A	?	0-3%	100A/797A	SEVERE	0-3%	10' to very poorly
RET	100A	?	0-3%	100A	?	0-3%	75' to poorly
RB	100A	?	0-3%	100A/797A	SEVERE	0-3%	30' to very poorly
RH	300A	?	0-3%	300A/C	?	0-3%/8-15%	85' to very poorly
RP	300A	?	0-3%	300A/C	?	0-3%/8-15%	90' to very poorly
RC	300A	?	0-3%	300A/C	?	0-3%/8-15%	70' to very poorly
	Adjacent to tidal marshes: In Town						
WRH	100A	?	0-3%	100A/B	?	0-3%/3-8%	50' to poorly
CSL	26A	SEVERE	0-3%	313A	SEVERE	0-3%	60' to poorly
KDBS	299A	?	0-3%	299E/313A	SEVERE	25-35%/0-3%	100' to poorly
KDBM	299A	?	0-3%	299E/313A	SEVERE	25-35%/0-3%	100' to poorly

SOIL DESCRIPTION

26A WINDSOR: Very deep, excessively drained sandy loam/loamy sand/sand
severe septic system limitaion-poor filter

100 UDORTHENTS: wet substratum:
poorly drained sandy loam filled w/moderate well drained sandy loam/sand fill or granular fill/black loamy sand over saturated wetland

299 UDORTHENTS: smoothed:
well drained smoothed sandy loam filled over w/ loamy fill

300 UDIPSAMMENT:
excessively drained excavated and eolian sand

313 DEERFIELD:
deep moderately well drained sandy loam/loamy sand/sand
severe septic system limitation-wetness, poor filter

497 PAWCATUCK:
very deep, very poorly drained saturated hemic materials/fsl/ls on tidal marsh fringe
severe septic system limitation-ponding, poor filter

797 MATUNUCK:
tidal marsh, flooded at high tide, very poorly drained saturated organic fibers/sand
severe septic system limitation

Table 5. Seabrook Well Statistics Summary					
Well	Total Well	Screened Interval Depths BGS		Current	Current
	Depth BGS	Top	Bottom	TOC Elevation	Stick-up
	(ft)	(ft)	(ft)	(ft)	(in)
CSL-1	7.00	1.00	6.00	87.22	0.00
CSL-2	7.00	1.00	6.00	87.36	0.00
CSL-3	7.00	1.00	6.00	85.61	0.00
CSL-4	7.00	1.00	6.00	86.47	0.00
CSL-5D	12.75	6.75	11.75	85.61	0.00
CSL-6	7.04	1.04	6.04	84.55	0.00
WRH-1	7.00	1.00	6.00	90.26	48.00
WRH-2	6.92	0.92	5.92	90.56	49.00
WRH-3D	14.67	8.67	13.67	88.48	38.00
WRH-4	7.46	1.46	6.46	88.79	42.50
WRH-5	7.00	1.00	6.00	90.53	48.00
WRH-6	7.00	1.00	6.00	87.68	48.00
WRH-7M	6.56	5.06	6.06	85.43	41.28
WRH-8M	6.06	4.56	5.56	85.57	47.28
WRH-9C	5.98	4.48	5.48	83.59	48.24
WRH-10C	5.68	4.18	5.18	83.27	51.84
RB-1	7.25	1.25	6.25	103.61	48.00
RB-2	7.21	1.21	6.21	103.32	45.50
RB-3	6.96	0.96	5.96	103.30	48.00
RB-4	7.03	1.03	6.03	103.38	44.13
RH-1	9.00	3.00	8.00	102.97	12.00
RH-2	9.96	3.96	8.96	102.79	12.50
RH-3	10.00	4.00	9.00	103.09	10.50
RH-4	9.97	3.97	8.97	102.35	6.88
RH-5	20.73	14.73	19.73	103.22	13.00
RP-1	10.12	4.12	9.12	101.46	0.00
RP-2	10.46	4.46	9.46	102.00	5.00
RP-3	10.50	4.50	9.50	102.57	7.13
RP-4	10.67	4.67	9.67	101.90	0.00
RP-5	18.25	12.25	17.25	101.96	0.00
RP-6B	6.65	5.15	6.15	92.55	40.20
RP-7B	4.96	3.46	4.46	94.45	60.48
RP-8B	6.18	4.58	5.68	92.11	45.84
RP-9B	7.01	5.49	6.49	95.29	35.88

RC-1	14.08	8.08	13.08	105.23	12.30
RC-2	11.00	5.00	10.00	104.72	6.00
RC-3	10.42	4.42	9.42	103.57	0.00
RC-4	10.52	4.52	9.52	102.12	0.00
KDB-1	9.38	3.38	8.38	100.00	0.00
KDB-2	10.79	4.79	9.79	100.26	0.00
KDB-3	9.50	3.50	8.50	100.29	0.00
KDB-4	9.40	3.40	8.40	100.15	0.00
KDB-5	8.81	2.81	7.81	97.02	0.00
KDB-6	9.18	3.18	8.18	97.10	0.00
KDB-7	9.22	3.22	8.22	98.70	0.00
KDB-8	10.20	4.20	9.20	97.57	0.00
KDB-9	16.30	10.30	15.30	98.39	0.00
KDB-10M	7.65	6.15	7.15	89.10	28.25
KDB-11M	6.77	5.27	6.27	91.26	38.75
KDB-12M	7.25	5.75	6.75	92.69	33.00
KDB-13C	5.23	3.73	4.73	85.32	57.25
KDB-14C	6.52	5.02	6.02	86.67	41.75
KDB-15M	6.63	5.13	6.13	91.81	40.50
FDC-1	10.19	4.19	9.19	29.69	0.00
FDC-2	8.90	2.90	7.90	29.61	0.00
FDC-3	9.30	3.30	8.30	29.87	0.00
FDC-4	10.60	4.60	9.60	29.90	0.00
FDC-5	10.80	4.80	9.80	24.49	40.50
RET-1	6.38	0.38	5.38	98.17	0.00
RET-2	7.08	1.08	6.08	101.55	45.75
RET-3	7.12	1.12	6.12	98.31	0.00
RET-4	6.98	0.98	5.98	100.59	24.00
RET-5	7.04	1.04	6.04	100.54	18.33
RET-6	7.06	1.06	6.06	98.85	0.00
REH-1	7.05	1.05	6.05	100.79	40.50
REH-2	6.96	0.96	5.96	100.93	40.50
REH-3	7.04	1.04	6.04	100.66	46.50
REH-3SS	7.61	6.11	7.11	99.18	28.74
REH-4	7.08	1.08	6.08	101.06	43.13
REH-5	7.02	1.02	6.02	100.93	44.50
REH-6	17.20	11.20	16.20	101.10	43.75
REH-7C	5.30	3.80	4.80	97.58	56.40
REH-8C	4.09	2.59	3.59	98.76	70.92

Table 6. Summary of Hydraulic Conductivity Tests				
Well	No. of Tests	K	K	Comments
		Avg	Avg	
		(ft/d)	(cm/s)	
CSL-1	--	--	--	Not Tested
CSL-2	3	1.517E+00	4.460E-05	
CSL-3	3	1.816E+00	5.340E-05	
CSL-4	3	2.667E+00	7.841E-05	
CSL-5D	3	3.369E-01	9.904E-06	
CSL-6	3	1.677E+00	4.929E-05	
WRH-1	3	3.869E-01	1.138E-05	
WRH-2	3	1.343E+00	3.949E-05	
WRH-3D	3	5.037E-01	1.481E-05	
WRH-4	3	4.626E+00	1.360E-04	
WRH-5	3	7.768E-01	2.284E-05	
WRH-6	3	3.335E+00	9.805E-05	
WRH-7M	3	1.461E+01	4.295E-04	
WRH-8M	3	9.664E+00	2.841E-04	
WRH-9C	3	6.419E+00	1.887E-04	
WRH-10C	3	8.728E+00	2.566E-04	
RH-1	4	1.647E+00	4.841E-05	
RH-2	4	6.663E-01	1.959E-05	
RH-3	4	1.209E+00	3.553E-05	
RH-4	4	4.770E-01	1.402E-05	
RH-5	4	1.106E+00	3.250E-05	
RP-1	4	4.160E-01	1.223E-05	
RP-2	4	1.586E-01	4.663E-06	
RP-3	4	1.040E+00	3.058E-05	
RP-4	4	5.849E-01	1.720E-05	
RP-5	4	5.806E-01	1.707E-05	
RP-6B	--	--	--	Not tested
RP-7B	--	--	--	Not tested
RP-8B	--	--	--	Not tested
RP-9B	--	--	--	Not tested
RC-1	4	5.637E+00	1.657E-04	
RC-2	--	--	--	Insufficient water in well
RC-3	4	8.173E-01	2.403E-05	
RC-4	1	7.509E-01	2.208E-05	

KDB-1	3	2.240E-01	6.586E-06	
KDB-2	4	5.671E+00	1.667E-04	
KDB-3	3	3.027E-01	8.898E-06	
KDB-4	2	3.075E+00	9.041E-05	
KDB-5	3	4.629E-01	1.361E-05	
KDB-6	3	7.126E-01	2.095E-05	
KDB-7	--	--	--	Insufficient water in well
KDB-8	--	--	--	Insufficient water in well
KDB-9	3	1.387E+00	4.077E-05	
KDB-10M	1	1.032E+00	3.035E-05	
KDB-11M	--	--	--	Insufficient response
KDB-12M	3	6.992E+01	2.056E-03	
KDB-14C	--	--	--	Not tested
KDB-13C	--	--	--	Not tested
KDB-15M	3	3.097E+00	9.104E-05	
FDC-1	2	2.141E-01	6.295E-06	
FDC-2	2	4.772E-01	1.403E-05	
FDC-3	--	--	--	Insufficient water in well
FDC-4	2	2.274E-01	6.686E-06	
FDC-5	--	--	--	Insufficient response
REH-1	3	1.841E+02	5.412E-03	
REH-2	4	3.503E-01	1.030E-05	
REH-3	4	9.149E-01	2.690E-05	
REH-4	4	1.743E+01	5.125E-04	
REH-5	4	2.232E-01	6.562E-06	
REH-6	4	7.779E+00	2.287E-04	

Table 7. Groundwater Elevation Time History Summary

WELL	GROUNDWATER ELEVATIONS (ft)													
	12/22/94 (ft)	3/7/95 (ft)	3/23/95 (ft)	4/4/95 (ft)	5/2/95 (ft)	5/22/95 (ft)	6/29/95 (ft)	7/17/95 (ft)	8/21/95 (ft)	10/19/95 (ft)	2/29/96 (ft)	4/4/96 (ft)	5/22/95 (ft)	6/6/96 (ft)
KDB-1	92.49	94.68	95.04	94.52	94.17	94.18	92.94	92.09	91.62	92.49	95.70	95.08	94.50	94.12
KDB-2	92.00	--	--	94.34	94.02	94.07	93.12	92.24	91.94	92.63	--	--	94.39	93.33
KDB-3	92.47	94.41	94.69	94.22	94.00	94.03	92.92	92.06	91.86	92.68	95.14	94.64	94.22	94.01
KDB-4	92.13	94.13	94.44	93.99	93.71	93.77	92.42	92.17	91.70	92.53	94.86	94.32	93.86	92.82
KDB-5	91.29	92.09	92.61	92.13	96.09	91.63	90.31	89.58	89.58	90.49	93.11	92.74	91.91	91.46
KDB-6	89.46	92.18	92.47	91.91	91.48	91.49	88.90	89.14	87.93	88.07	92.48	92.48	91.61	91.17
KDB-7	92.28	90.10	93.36	92.84	92.33	92.35	90.99	91.54	90.22	91.20	93.92	93.35	92.72	92.22
KDB-8	97.57	92.80	93.33	92.69	92.08	92.29	90.17	89.38	89.11	90.24	93.76	93.76	92.80	92.47
KDB-9	98.39	91.36	94.49	91.68	86.12	91.05	90.04	96.16	96.16	96.16	96.16	96.16	91.36	90.40
KDB-10													84.15	83.94
KDB-11													84.44	84.32
KDB-12													91.99	91.59
KDB-13													83.82	83.77
KDB-14													80.98	78.36
KDB-15													91.81	91.81

WELL	GROUNDWATER ELEVATIONS (ft)															
	12/14/94 (ft)	2/16/95 (ft)	3/2/95 (ft)	3/30/95 (ft)	4/6/95 (ft)	5/11/95 (ft)	6/29/95 (ft)	7/12/95 (ft)	8/16/95 (ft)	11/14/95 (ft)	11/18/95 (ft)	2/1/96 (ft)	2/8/96 (ft)	3/28/96 (ft)	5/9/96 (ft)	6/6/96 (ft)
WRH-1	82.94	83.35	83.66	83.27	83.09	82.51	81.45	81.43	81.35	--	84.09	84.28	83.25	84.35	83.70	82.81
WRH-2	83.35	90.56	84.46	83.37	83.13	82.49	82.12	81.45	81.37	--	84.22	83.95	83.33	83.84	83.49	82.88
WRH-3D	85.12	82.83	82.96	82.81	82.61	82.09	81.23	81.28	81.16	82.99	83.39	83.26	82.90	83.21	82.91	82.33
WRH-4	82.99	88.79	82.98	82.81	82.59	82.04	81.12	80.14	79.97	82.95	83.29	83.21	82.83	83.15	82.90	82.40
WRH-5	82.31	90.53	83.29	83.27	82.85	82.31	81.58	81.40	81.35	84.54	84.07	84.37	83.22	84.26	83.28	82.68
WRH-6	82.76	87.68	82.43	82.32	82.10	81.74	80.68	80.03	79.80	--	82.59	82.50	82.29	82.53	82.36	81.88
WRH-7															81.94	81.52
WRH-8															81.57	81.42
WRH-9															80.18	80.22
WRH-10															80.33	80.28

WELL	GROUNDWATER ELEVATIONS (ft)													
	12/14/94 (ft)	2/16/95 (ft)	2/23/95 (ft)	3/30/95 (ft)	5/11/95 (ft)	6/5/95 (ft)	6/29/95 (ft)	7/12/95 (ft)	8/16/95 (ft)	10/26/95 (ft)	2/22/96 (ft)	4/11/96 (ft)	6/3/96 (ft)	6/6/96 (ft)
CSL-1	83.95	83.58	83.90	84.25	83.28	83.25	82.73	82.45	82.17	83.28	85.29	84.92	83.62	87.22
CSL-2	83.62	83.30	83.54	86.51	83.02	83.01	82.56	82.18	81.91	83.02	85.01	84.58	83.44	83.52
CSL-3	83.18		83.07	83.00	82.45	82.47	81.86	81.50	81.39	82.74	84.73	83.99	82.64	85.61
CSL-4	83.56		83.51	83.48	82.94	82.84	82.32	81.95	81.83	82.99	84.82	84.35	83.15	83.25
CSL-5	83.24	91.66	91.83	91.83	82.69	82.84	81.98	81.79	81.57	82.65	--	84.15	82.99	85.61
CSL-5D	83.45													
CSL-6	82.50		82.40	82.20	81.83	81.73	81.05	80.88	80.58	82.24	83.86	83.35	81.81	81.96

WELL	GROUNDWATER ELEVATIONS (ft)						
	12/6/94 (ft)	3/15/95 (ft)	5/31/95 (ft)	6/6/95 (ft)	6/29/95 (ft)	7/7/95 (ft)	6/6/96 (ft)
RB-1	96.4						
RB-2	97.04	96.46	95.27	94.87	95.05	94.99	--
RB-3	98.04	96.47	95.28	94.95	95.06	95.01	99.34
RB-4	97.39	98.81	95.83	95.17	95.42	95.29	--

WELL	GROUNDWATER ELEVATIONS (ft)													
	12/6/94 (ft)	12/7/94 (ft)	3/15/95 (ft)	5/24/95 (ft)	6/6/95 (ft)	6/29/95 (ft)	7/10/95 (ft)	7/24/95 (ft)	11/7/95 (ft)	2/20/96 (ft)	3/12/96 (ft)	4/26/96 (ft)	5/28/96 (ft)	6/6/96 (ft)
RH-1	95.13	96.42	99.73	94.81	94.52	94.49	94.95	96.12	95.02	95.34	94.68	95.18	94.46	94.96
RH-2	96.29	96.45	98.52	94.79	94.54	94.55	94.65	95.57	94.80	94.99	94.35	94.98	94.47	94.91
RH-3	96.17	96.34	95.68	94.96	94.58	94.53	94.91	95.56	--	95.33	94.70	95.30	94.49	95.07
RH-4	102.35	102.35	97.39	95.17	94.75	94.69	95.00	95.56	--	95.36	94.66	95.15	94.61	95.06
RH-5	103.22	92.20	96.84	95.75	92.44	95.46	96.21	96.34	--	93.31	92.89	93.85	93.43	93.19

WELL	GROUNDWATER ELEVATIONS (ft)										
	12/10/94 (ft)	3/15/95 (ft)	5/18/95 (ft)	5/24/95 (ft)	6/29/95 (ft)	7/10/95 (ft)	7/24/95 (ft)	12/5/95 (ft)	4/23/96 (ft)	5/28/96 (ft)	6/6/96 (ft)
RP-1	94.85	94.71	94.25	93.91	93.40	93.72	93.48	93.96	94.16	--	94.02
RP-2	95.21	98.49	94.10	93.57	93.25	93.69	93.40	93.75	93.82	--	93.65
RP-3	95.29	94.75	94.27	94.46	93.56	93.89	93.58	94.28	94.27	--	93.89
RP-4	94.90	94.71	94.35	94.52	93.40	93.75	93.44	93.80	94.11	--	93.64
RP-5	--	95.78	90.76	93.31	93.71	94.98	93.61	95.69	92.41	--	93.94
RP-6									89.45	89.48	--
RP-7									89.35	89.50	--
RP-8									86.52	86.61	--
RP-9									92.10	92.11	92.79

Table 7. Con't

WELL	GROUNDWATER ELEVATIONS (ft)											
	12/10/94 (ft)	3/23/95 (ft)	5/18/95 (ft)	5/24/95 (ft)	6/29/95 (ft)	7/10/95 (ft)	8/23/95 (ft)	11/16/95 (ft)	12/5/95 (ft)	3/12/96 (ft)	4/26/96 (ft)	6/6/96 (ft)
RC-1	96.20	96.02	96.23	95.08	95.00	94.86	96.07	95.86	95.00	94.78	95.76	100.51
RC-2	98.97	93.72	91.22	95.60	94.29	95.45	94.53	96.70	96.30	--	91.48	94.46
RC-3	--	97.22	95.67	95.72	94.73	95.07	95.77	95.79	95.04	94.92	95.22	93.30
RC-4	--	96.12	95.17	97.82	94.37	94.62	94.60	95.19	94.77	94.57	95.00	93.74

WELL	GROUNDWATER ELEVATIONS (ft)								
	10/3/94 (ft)	3/13/95 (ft)	4/13/95 (ft)	5/4/95 (ft)	5/31/95 (ft)	6/29/95 (ft)	7/5/95 (ft)	5/2/96 (ft)	6/6/96 (ft)
RET-1	94.56	97.52	95.73	95.73	94.75	94.10	94.06	94.32	94.07
RET-2	96.33	96.85	96.85	97.37	94.79	94.10	94.16	94.99	94.82
RET-3	94.77	97.61	96.99	95.70	92.98	94.17	94.09	95.44	94.61
RET-4	94.41	97.94	96.79	96.07	95.09	--	94.31	--	93.80
RET-5	93.96	98.53	96.71	96.05	95.04	94.09	94.16	95.19	95.15
RET-6	92.82	98.85	96.99	89.44	94.62	--	94.08	--	--

WELL	GROUNDWATER ELEVATIONS (ft)												
	10/3/94 (ft)	3/13/95 (ft)	4/13/95 (ft)	5/4/95 (ft)	5/31/95 (ft)	6/29/95 (ft)	7/5/95 (ft)	7/18/95 (ft)	8/2/95 (ft)	10/5/95 (ft)	4/18/96 (ft)	5/23/96 (ft)	6/6/96 (ft)
REH-1	96.92	96.89	96.14	95.27	94.59	94.27	94.19	95.86	94.21	95.03	96.20	94.92	95.45
REH-2	95.91	95.03	95.21	95.20	95.18	94.78	94.77	95.83	94.95	95.71	95.75	95.12	94.99
REH-3	96.76	95.11	95.26	95.36	95.33	94.80	94.32	94.16	93.52	94.21	--	93.24	96.32
REH-4	95.91	96.06	96.03	95.30	95.09	94.49	94.50	99.97	96.27	99.11	96.86	95.21	96.00
REH-5	95.47	95.31	95.31	95.31	95.13	94.88	94.83	96.53	95.42	95.71	96.21	95.21	95.72
REH-6	101.10	96.31	96.05	91.69	93.00	94.36	93.10	92.34	92.71	94.97	94.08	86.71	94.43
REH-7												93.42	94.88
REH-8												93.42	94.78

WELL	GROUNDWATER ELEVATIONS (ft)							
	12/22/95 (ft)	3/9/95 (ft)	4/6/95 (ft)	5/2/95 (ft)	5./22/95 (ft)	6/5/95 (ft)	6/29/95 (ft)	6/6/96 (ft)
FDC-1	93.05	23.69	23.54	23.26	23.41	23.15	22.82	22.92
FDC-2	94.54	25.19	24.79	24.39	24.46	24.38	23.99	24.55
FDC-3	93.04	24.28	23.84	23.33	23.82	23.48	21.46	22.93
FDC-4	94.43	24.80	24.69	24.24	24.57	24.15	23.67	23.66
FDC-5	88.13	19.17	18.29	18.20	18.39	17.92	17.38	18.25

TABLE 8A: Site REH-Nutrient Database																
WELL: REH-1							WELL: REH-1	um	mg/L	um	mg/L	mg/L	um	mg/L		
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	15.00						12/7/94	10.96	0.15	121.71	1.70	1.86	0.320	0.025	LF	M
2/7/95							2/7/95								L	FROZEN
3/13/95	9.80	5.20		3.90	91.14	9.09	3/13/95	5.70	0.08	39.66	0.56	0.63	0.104	0.008	L	PF
4/13/95				4.65			4/13/95								H	NO B/N
5/4/95	6.00		7.10	5.52	1398.00	6.72	5/4/95	5.25	0.07	162.35	2.27	2.35	0.022	0.002	L	NO B
5/31/95				6.20			5/31/95								L	NO B/N
6/12/95	15.00		7.44	5.37	258.67	13.92	6/12/95	1.03	0.01	0.00	0.00	0.01	7.444	0.588	HE	NO B
7/5/95		20.00		6.60			7/5/95								L	NO B/N
7/18/95		17.00		4.84			7/18/95								LE	NO B/N
8/2/95				6.49			8/2/95								LF	NO N, MPN
10/5/95	20.00		5.78	5.67			10/5/95	0.00	0.00	59.98	0.84	0.84	0.844	0.067	H	PF
12/28/95	10.00						12/28/95	0.20	0.00	13.75	0.19	0.20	0.116	0.009	LE	PF
4/18/96	12.00	8.50	5.98	4.50			4/18/96	0.71	0.01	10.76	0.15	0.16	1.455	0.115	HF	PF
5/23/96	10.00	17.00	4.99	5.87			5/23/96	0.00	0.00	43.41	0.61	0.61	5.963	0.471	L	NO B
MEAN=	12.23	13.54	6.26	5.42			MEAN=		0.04		0.79	0.83		0.161		
MEDIAN	11.00	17.00	5.98	5.52			MEDIAN		0.01		0.58	0.62		0.046		
STDDEV	4.32	6.34	1.00	0.87			STDDEV		0.06		0.80	0.84		0.233		
N	8	5	5	11			N		8		6	6		8		
WELL:	REH-2						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	13.00						12/7/94	817.61	11.45	84.66	1.19	12.63	0.110	0.009	LF	M
2/7/95							2/7/95								L	FROZEN
3/13/95	3.40	8.60		4.88			3/13/95								L	NO B/N
4/13/95				4.70			4/13/95								H	NO B/N
5/4/95				4.71			5/4/95								L	NO B/N
5/31/95				4.73			5/31/95								L	NO B/N
6/12/95	5.00		7.32	3.82	2091.00	4.57	6/12/95	271.39	3.80	0.00	0.00	3.80	0.440	0.035	HE	NO B
7/5/95		20.00		5.14			7/5/95								L	NO B/N
7/18/95		17.50		4.00			7/18/95								LE	NO B/N
8/2/95				4.88			8/2/95								LF	NO N, MPN
10/5/95	17.00		6.84	4.12			10/5/95	606.93	8.50	1300.05	18.20	26.70	0.203	0.016	H	PF
12/28/95	4.00						12/28/95	701.44	9.82	1182.28	16.55	26.37	0.001	0.000	LE	PF
4/18/96	4.00	9.40	7.45	4.08			4/18/96	55.85	0.78	1536.85	21.52	22.30	0.232	0.018	HF	PF
5/23/96	5.00	16.00	6.49	4.79			5/23/96	11.33	0.16	1270.76	17.79	17.95	1.875	0.148	L	PF
MEAN=	7.34	14.30	7.03	4.53			MEAN=		5.75		12.54	18.29		0.038		
MEDIAN	5.00	16.00	7.08	4.71			MEDIAN		6.15		17.17	20.12		0.017		
STDDEV	5.39	5.05	0.44	0.44			STDDEV		4.82		9.41	8.88		0.055		
N	7	5	4	11			N		6		6	6		6		

WELL:	REH-3						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	15.00						12/7/94	54.95	0.77	70.02	0.98	1.75	0.100	0.008	LF	M
2/7/95							2/7/95								L	FROZEN
3/13/95	9.00	10.00		5.55			3/13/95								L	NO B/N
4/13/95				5.40			4/13/95								H	NO B/N
5/4/95				5.30			5/4/95								L	NO B/N
5/31/95				5.33			5/31/95								L	NO B/N
6/12/95	9.00		7.05	4.55	102.33	9.77	6/12/95	7.48	0.10	139.70	1.96	2.06	0.354	0.028	HE	NO B
7/5/95		21.00		6.34			7/5/95								L	NO B/N
7/18/95	16.00	17.50	7.04	5.04	169.00	11.83	7/18/95	12.56	0.18	28.36	0.40	0.57	0.000	0.000	LE	NO B
8/2/95				5.68			8/2/95								LF	NO N, MPN
10/5/95	20.50		7.08	4.99			10/5/95	0.00	0.00	66.56	0.93	0.93	0.118	0.009	H	PF
12/28/95							12/28/95								LE	PF
4/18/96	16.00	8.00	7.08	5.50			4/18/96	7.07	0.10	205.68	2.88	2.98	2.016	0.159	HF	PF
5/23/96	18.00	13.00	7.08	5.94			5/23/96	1.77	0.02	85.64	1.20	1.22	0.443	0.035	L	PF
MEAN=	15.07	13.90	7.07	5.42			MEAN=		0.20		1.39	1.59		0.040		
MEDIAN	16.00	13.00	7.08	5.40			MEDIAN		0.10		1.09	1.49		0.019		
STDDEV	4.49	5.34	0.02	0.48			STDDEV		0.29		0.89	0.87		0.060		
N	7	5	5	11			N		6		6	6		6		
WELL:	REH-4						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	15.00						12/7/94	5.93	0.08	233.94	3.28	3.36	0.130	0.010	LF	M
2/7/95							2/7/95								L	FROZEN
3/13/95				5.00			3/13/95								L	NO B/N
4/13/95				5.03			4/13/95								H	NO B/N
5/4/95				5.76			5/4/95								L	NO B/N
5/31/95				5.97			5/31/95								L	NO B/N
6/12/95				5.19			6/12/95								HE	NO B/N
7/5/95		23.00		6.56			7/5/95								L	NO B/N
7/18/95		17.00		4.67			7/18/95								LE	NO B/N
8/2/95				8.37			8/2/95								LF	NO N, MPN
10/5/95	17.00			5.53			10/5/95	6.51	0.09	313.50	4.39	4.48	0.469	0.037	H	NO B
12/28/95							12/28/95								LE	NO B/N
4/18/96		9.50		4.18			4/18/96								HF	NO B/N
5/23/96		15.50		5.85			5/23/96								L	NO N/B
MEAN=	16.00	16.25		5.65			MEAN=		0.09		3.83	3.92		0.024		
							MEDIAN		0.09		3.83	3.92		0.024		
							STDDEV		0.01		0.79	0.79		0.019		
							N		2		2	2		2		

WELL:	REH-5						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	4.00						12/7/94	1090.75	15.27	1378.97	19.31	34.58	0.200	0.016	LF	M
2/7/95	6.50	1.00	7.38		20.50		2/7/95	9.94	0.14	1435.73	20.10	20.24	0.104	0.008	L	NO B
3/13/95	1.80	8.50		5.62			3/13/95								L	NO B/N
4/13/95				5.62			4/13/95								H	NO B/N
5/4/95				5.62			5/4/95								L	NO B/N
5/31/95				5.80			5/31/95								L	NO B/N
6/12/95				4.66			6/12/95								HE	NO B/N
7/5/95		19.00		6.10			7/5/95								L	NO B/N
7/18/95		17.00		4.48			7/18/95								LE	NO B/N
8/2/95				5.59			8/2/95								LF	NO N, MPN
10/5/95	0.00			5.30			10/5/95	897.06	12.56	1235.00	17.29	29.85	0.216	0.017	H	PF
12/28/95	4.00						12/28/95	18.76	0.26	1221.49	17.10	17.36	0.001	0.000	LE	PF
4/18/96	2.00	9.00	6.81	4.68			4/18/96	1.81	0.03	1389.83	19.46	19.48	0.272	0.021	HF	PF
5/23/96	0.00	15.50	7.43	5.72			5/23/96	3.55	0.05	1438.16	20.13	20.18	0.234	0.018	L	PF
MEAN=	2.61	11.67	7.21	5.38			MEAN=		4.72		18.90	23.62		0.014		
MEDIAN	2.00	12.25	7.38	5.62			MEDIAN		0.20		19.38	20.21		0.016		
STDDEV	2.37	6.75	0.34	0.53			STDDEV		7.18		1.36	6.90		0.008		
N	7	6	3	11			N		6		6	6		6		

WELL:	REH-6 DEEP						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94							12/7/94								LF	NO WELL
2/7/95	13.90	3.50			20.50		2/7/95	0.33	0.00	772.37	10.81	10.82	0.032	0.003	L	S
3/13/95	10.20	7.60		4.79	54.80	8.39	3/13/95	3.71	0.05	48.79	0.68	0.73	3.987	0.315	L	PF
4/13/95	2.00			5.05	29.80	20.81	4/13/95	5.24	0.07	217.51	3.05	3.12	10.708	0.846	H	PF
5/4/95	10.00		6.82	9.41	4.20	23.81	5/4/95	0.76	0.01	399.23	5.59	5.60	9.980	0.788	L	PF
5/31/95	13.00		6.63	8.10	21.00	7.14	5/31/95	2.55	0.04	442.84	6.20	6.24	12.235	0.966	L	PF
6/12/95	12.00		6.95	7.08	30.00	2.67	6/12/95	2.46	0.03	368.58	5.16	5.19	7.482	0.591	HE	PF
7/5/95	13.00	12.90	6.84	8.00	23.80	9.24	7/5/95	0.57	0.01	331.71	4.64	4.65	2.176	0.172	L	PF
7/18/95	12.00	12.50	7.03	8.65	219.25	2.51	7/18/95	2.82	0.04	117.40	1.64	1.68	6.204	0.490	LE	PF
8/2/95	12.00	16.10	6.92	8.28	33.60	13.69	8/2/95	2.06	0.03	30.56	0.43	0.46	7.850	0.620	LF	PF
10/5/95	10.50		6.82	6.02			10/5/95	5.99	0.08	297.28	4.16	4.25	0.226	0.018	H	PF
12/28/95	17.00						12/28/95	0.73	0.01	168.60	2.36	2.37	0.047	0.004	LE	PF
4/18/96	16.00		6.14	6.97			4/18/96	0.00	0.00	127.55	1.79	1.79			HF	NO B
5/23/96	16.00	17.00	5.53	14.39	14.39		5/23/96	0.00	0.00	61.44	0.86	0.86	0.945	0.075	L	NO B
MEAN	12.12	11.60	6.63	7.89			MEAN		0.03		3.64	3.67		0.407		
MEDIAN	12.00	12.70	6.82	8.00			MEDIAN		0.03		3.05	3.12		0.402		
STDDEV	3.78	5.17	0.49	2.61			STDDEV		0.03		2.91	2.91		0.355		
N	13	6	9	11			N		13		13	13		12		

WELL:	REH-7						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/18/96	16	8	6.19	3.97			4/18/96	6.57	0.09	291.57	4.08	4.18	1.827	0.144	HF	PF
5/23/96	16	11.9	7.03	4.16			5/23/96	2.82	0.04	209.62	2.93	2.97	1.24	0.098	L	PF
MEAN	16	9.95	6.61	4.065			MEAN		0.07		3.51	3.57		0.121		
							MEDIAN		0.07		3.51	3.57		0.121		
							STDDEV		0.04		0.81	0.85		0.033		
							N		2		2	2		2		

WELL:	REH-8						WELL:									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/18/96	17	8	6.78	5			4/18/96	4.70	0.07	161.61	2.26	2.33	2.15	0.170	HF	PF
5/23/96	18	13.6	6.85	5.34			5/23/96	1.69	0.02	157.97	2.21	2.24	2.523	0.199	L	PF
MEAN	17.50	10.80	6.82	5.17			MEAN		0.04		2.24	2.28		0.185		
							MEDIAN		0.04		2.24	2.28		0.185		
							STDDEV		0.03		0.04	0.07		0.021		
							N		2.00		2.00	2.00		2.00		

TABLE 8A: Site REH-Microbiological Database

WELL: REH-1

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*0*	*700*	*LF*	*M*
2/7/95					L	FROZEN
3/13/95	0.24	0.24	0.24	0.24	L	FF
4/13/95					H	NO B/N
5/4/95					L	NO B
5/31/95					L	NO B/N
6/12/95					HE	NO B
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	*0*	*0*			*LF*	*NO N, MPN*
10/5/95	0.09	0.09			H	FF
12/28/95	0.49	0.49	0.49	0.49	LE	FF
4/18/96	0.49	0.49			HF	FF
5/23/96					L	NO B
GEOMEAN=	0.27	0.27	0.34	0.34		
STDEV	0.20	0.20	0.18	0.18		
COUNT=	4.00	4.00	2.00	2.00		

WELL: REH-2

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*0*	*63*	*LF*	*M*
2/7/95					L	FROZEN
3/13/95					L	NO B/N
4/13/95					H	NO B/N
5/4/95					L	NO B/N
5/31/95					L	NO B/N
6/12/95					HE	NO B
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	*0*	*0*			*LF*	*NO N, MPN*
10/5/95	0.09	0.09	0.09	0.09	H	FF
12/28/95	0.49	0.49	0.49	0.49	LE	FF
4/18/96	0.49	0.49			HF	FF
5/23/96	0.49	0.49			L	FF
GEOMEAN=	0.32	0.32	0.21	0.21		
STDEV	0.20	0.20	0.28	0.28		
COUNT=	4.00	4.00	2.00	2.00		

WELL: REH-3

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*0*	*0*	*LF*	*M*
2/7/95					L	FROZEN
3/13/95	0.49	0.49	0.49	0.49	L	NO B/N
4/13/95					H	NO B/N
5/4/95					L	NO B/N
5/31/95					L	NO B/N
6/12/95					HE	NO B
7/5/95					L	NO B/N
7/18/95					LE	NO B
8/2/95	*0*	*0*			*LF*	*NO N, MPN*
10/5/95	0.24	0.24	0.24	0.24	H	FF
12/28/95	0.49	0.49	0.49	0.49	LE	FF
4/18/96	0.49	0.49	0.24	0.24	HF	FF
5/23/96	0.24	0.24	0.24	0.24	L	FF
GEOMEAN=	0.37	0.37	0.32	0.32		
STDEV	0.14	0.14	0.14	0.14		
COUNT=	5.00	5.00	5.00	5.00		

WELL: REH-4

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
12/7/94			0	0	LF	M
2/7/95					L	FROZEN
3/13/95					L	NO B/N
4/13/95					H	NO B/N
5/4/95					L	NO B/N
5/31/95					L	NO B/N
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	*0*	*0*			*LF*	*NO N, MPN*
10/5/95					H	NO B
12/28/95	0.09	0.09			LE	NO B/N
4/18/96					HF	NO B
5/23/96					L	NO B

WELL: REH-5

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*0*	*0*	*LF*	*M*
2/7/95					L	NO B
3/13/95					L	NO B/N
4/13/95					H	NO B/N
5/4/95					L	NO B/N
5/31/95					L	NO B/N
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	*0*	*0*		*500*	*LF*	*NO N, MPN*
10/5/95	0.09	0.09	0.09	5	H	FF
12/28/95	0.49	0.49	0.49		LE	FF
4/18/96	0.49	0.49	0.5	0.49	HF	NO B
5/23/96	0.5	0.5			L	FF
GEOMEAN=	0.32	0.32	0.28	1.57		
STDEV	0.20	0.20	0.23	3.19		
COUNT	4.00	4.00	3.00	2.00		

WELL: REH-6

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
12/7/94					LF	NO WELL
2/7/95	*29*	*3*	*0*	*0*	*L*	*S*
3/13/95	7	0.75	0.24	0.24	L	FF
4/13/95	0.24	0.24	0.24	0.24	H	FF
5/4/95	0.24	0.24	0.24	0.24	L	FF
5/31/95	0.24	0.24	0.24	0.24	L	FF
6/12/95	0.24	0.24	0.24	0.24	HE	FF
7/5/95	0.24	0.24	0.24	0.24	L	FF
7/18/95	0.24	0.24	0.24	0.24	LE	FF
8/2/95	0.24	0.24	0.24	0.24	LF	FF
10/5/95	0.24	0.24	0.24	0.24	H	FF
12/28/95	0.24	0.24	0.24	0.24	LE	FF
4/18/96					HF	NO B
5/23/96					L	NO B
GEOMEAN=	0.34	0.27	0.24	0.24		
STDEV	2.14	0.16	0.00	0.00		
COUNT=	10.00	10.00	10.00	10.00		

WELL: REH-7

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
4/18/96	0.24	0.24	0.24	0.24	HF	FF
5/23/96	0.24	0.24	0.24	0.24	L	FF
GEOMEAN=	0.24	0.24	0.24	0.24		

WELL: REH-8

DATE	FC	Ec	Enteroccoci	CP	TIDE	FILTER
4/18/96	0.24	0.24	0.24	0.24	HF	FF
5/23/96	0.24	0.24	0.24	0.24	L	FF
GEOMEAN=	0.24	0.24	0.24	0.24		

TABLE 8B: Site RET-Nutrient Database

WELL: RET-1							WELL: RET-1	um	mg/L	um	mg/L	mg/L	um	mg/L		
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	0.00						12/7/94	14.44	0.20	184.62	2.58	2.79	0.14	0.01	LF	M
2/7/95							2/7/95								L	NO B/N
3/13/95	2.20	3.00		0.65	12.00	13.33	3/13/95	5.03	0.07	313.23	4.39	4.46	0.15	0.01	L	FF
4/13/95	1.00			1.17	14.20	21.13	4/13/95	3.96	0.06	313.31	4.39	4.44	0.19	0.01	H	FF
5/4/95	2.00		7.46	2.44	62.57	7.98	5/4/95	0.01	0.00	185.85	2.60	2.60	0.02	0.00	L	FF
5/31/95				3.42			5/31/95								L	NO B/N
6/12/95				3.29			6/12/95								HE	NO B/N
7/5/95		21.00		4.11			7/5/95								L	NO B/N
7/18/95		18.00		4.85			7/18/95								LE	NO B/N
8/2/95				4.98			8/2/95								LF	NO N, MPN
10/10/95				3.73			10/10/95								H	NO N/B
5/2/96		14.50		3.85			5/2/96								H	NO B/N
MEAN	1.30	14.13	7.46	3.23			MEAN		0.08		3.49	3.57		0.010		
MEDIAN	1.50	16.25	7.46	3.58			MEDIAN		0.08		3.49	3.61		0.012		
STDDEV	1.01	7.86		1.42			STDDEV		0.09		1.03	1.02		0.008		
N	4	4	1	10			N		4		4	4		4		

WELL: RET-2							WELL: RET-2									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/95	0.00						12/7/95	44.54	0.62	136.89	1.91	2.54	0.12	0.01	LF	M
2/7/95	0.50	1.00	7.42		13.60		2/7/95	8.18	0.11	321.94	4.51	4.62	0.02	0.00	L	S
3/13/95	0.40	5.80		4.70	7.00	17.14	3/13/95	45.35	0.63	64.75	0.91	1.54	0.61	0.05	L	FF
4/13/95	0.00				7.00	28.57	4/13/95	53.84	0.75	1037.06	14.52	15.27	0.11	0.01	H	FF
5/4/95	0.00		7.35	4.18	8.60	23.26	5/4/95	105.84	1.48	1169.83	16.38	17.86	0.06	0.00	L	FF
5/31/95				6.76			5/31/95								L	NO B/N
6/12/95				6.82			6/12/95								HE	NO B/N
7/5/95				7.39			7/5/95								L	NO B/N
7/18/95		18.00		7.95			7/18/95								LE	NO B/N
8/2/95				7.05			8/2/95								LF	NO N, MPN
10/10/95	0.00	19.00		5.77			10/10/95	138.73	1.94	1121.25	15.70	17.64	0.16	0.01	H	FF
5/2/96	0.00	14.40	7.80	6.56			5/2/96	187.44	2.62	1547.45	21.66	24.29	0.22	0.02	H	FF
MEAN=	0.13	11.64	7.52	6.35			MEAN=		1.17		10.80	11.97		0.015		
MEDIAN	0.00	14.40	7.42	6.76			MEDIAN		0.75		14.52	15.27		0.009		
STDDEV	0.22	7.90	0.24	1.24			STDDEV		0.88		8.20	8.96		0.016		
N	7	5	3	9			N		7		7	7		7.000		

WELL: RET-3							WELL: RET-3									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	0.00						12/7/94	16.32	0.26	1146.15	16.05	16.30	0.17	0.01	LF	M
2/7/95							2/7/95								L	NO B/N
3/13/95	4.00	3.80		0.70	216.67	7.54	3/13/95	7.14	0.10	73.16	1.02	1.12	0.08	0.01	L	FF
4/13/95	1.00			1.32	115.40	7.60	4/13/95	0.00	0.00	1346.47	16.85	16.85	1.98	0.16	H	FF
5/4/95	3.00		7.36	2.61	25.20	16.25	5/4/95	0.30	0.00	743.35	10.41	10.41	0.02	0.00	L	FF
5/31/95							5/31/95								L	NO B/N
6/12/95							6/12/95								HE	well bent
7/5/95				4.22			7/5/95								L	NO B/N
7/18/95		19.50		2.92			7/18/95								LE	NO B/N
8/2/95				4.63			8/2/95								LF	NO N, MPN
10/10/95				2.10			10/10/95								H	NO B/N
5/2/96		14.50		2.87			5/2/96								H	NO B/N
MEAN=	2.00	12.60	7.36	2.67			MEAN=		0.09		11.58	11.67		0.045		
MEDIAN	2.00	14.50	7.36	2.74			MEDIAN		0.05		13.23	13.36		0.010		
STDDEV	1.83	8.02	###	1.33			STDDEV		0.12		7.87	7.87		0.075		
N	4	3	1	8			N		4		4	4		4		

WELL: RET-4							WELL: RET-4									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	0.00						12/7/94	27.13	0.38	91.46	1.28	1.66	0.40	0.03	LF	M
2/7/95	3.20	1.00					2/7/95								L	S, NO N
3/13/95	2.20	3.80		2.65	11.60	17.24	3/13/95	4.43	0.06	16.80	0.24	0.30	0.04	0.00	L	FF
4/13/95	2.00			3.60	12.60	20.31	4/13/95	2.70	0.04	82.72	1.16	1.20	0.30	0.02	H	FF
5/4/95	0.00		7.50	4.52	28.67	23.26	5/4/95	1.15	0.02	49.58	0.69	0.71	0.02	0.00	L	FF
5/31/95	0.00	15.20	7.68	5.50	19.00	19.30	5/31/95	2.12	0.03	57.33	0.80	0.83	0.29	0.02	L	FF
6/12/95	0.00		7.85	5.54	89.75	6.41	6/12/95	0.31	0.00	78.77	1.10	1.11	0.20	0.02	HE	FF
7/5/95		23.00		6.28			7/5/95								L	NO B/N
7/18/95	1.00	17.50	7.02		42.00	0.48	7/18/95	1.88	0.03	198.41	2.78	2.80	0.03	0.00	LE	NO B
8/2/95				5.90			8/2/95								LF	NO N, MPN
10/10/95							10/10/95								H	no access
5/2/96		14.30					5/2/96								H	NO B/N
MEAN=	1.05	12.47	7.51	4.88			MEAN=		0.08		1.15	1.23		0.014		
MEDIAN=	0.50	14.75	7.59	5.50			MEDIAN=		0.03		1.10	1.11		0.016		
STDDEV	1.27	8.41	0.36	1.30			STDDEV		0.13		0.80	0.81		0.012		
N	8	6	4	7			N		7		7	7		7		

WELL: RET-5							WELL: RET-5									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	0.00						12/7/94	71.01	0.99	55.64	0.78	1.77	0.15	0.01	LF	M
2/7/95	2.00	1.00			30.80		2/7/95	1.68	0.02	137.19	1.92	1.94	0.04	0.00	L	S
3/13/95	3.00	4.00		2.01	12.20	22.95	3/13/95	14.57	0.20	16.39	0.23	0.43	0.09	0.01	L	FF
4/13/95	1.00			3.83	6.00	26.67	4/13/95	16.00	0.22	54.11	0.76	0.98	0.37	0.03	H	FF
5/4/95	1.00		7.66	4.49	7.20	30.56	5/4/95	1.95	0.03	168.20	2.35	2.38	0.08	0.01	L	FF
5/31/95	0.00	13.50	7.77	5.50	18.00	9.26	5/31/95	0.01	0.00	46.15	0.65	0.65	0.26	0.02	L	FF
6/12/95				5.67			6/12/95								HE	NO B/N
7/5/95				6.38			7/5/95								L	NO B/N
7/18/95		19.00		5.88			7/18/95								LE	NO B/N
8/2/95				6.09			8/2/95								LF	NO N, MPN
10/10/95	0.00			5.00			10/10/95	5.50	0.08	49.60	0.69	0.77	0.09	0.01	H	FF
5/2/96	0.00	14.30	6.03	5.35			5/2/96	13.81	0.19	47.36	0.66	0.86	0.11	0.01	H	FF
MEAN=	0.88	10.38	7.16	5.02			MEAN=		0.22		1.01	1.22		0.012		
MEDIAN	0.50	13.50	7.66	5.43			MEDIAN		0.14		0.73	0.92		0.008		
STDDEV	1.13	7.65	0.97	1.38			STDDEV		0.33		0.73	0.71		0.008		
N	8	5	3	10			N		8		8	8		8		

WELL: RET-6							WELL: RET-6									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94							12/7/94								LF	NO WELL
2/7/95	2.20	1.00			36.90		2/7/95	212.43	2.97	269.29	3.77	6.74	0.07	0.01	L	S
3/13/95	2.80	5.00		0.00	152.75	5.73	3/13/95	6.14	0.09	27.32	0.38	0.47	3.10	0.24	L	FF
4/13/95	2.00			1.88	26.20	11.45	4/13/95	5.63	0.08	190.93	2.67	2.75	7.61	0.62	H	FF
5/4/95							5/4/95								L	NO B/N
5/31/95				4.23			5/31/95								L	NO B/N
6/12/95				4.18			6/12/95								HE	NO B/N
7/5/95				4.77			7/5/95								L	NO B/N
7/18/95		18.60		4.22			7/18/95								LE	NO B/N
8/2/95				4.54			8/2/95								LF	NO N, MPN
10/10/95				3.54			10/10/95								H	NO B/N
5/2/96		14.40					5/2/96								H	NO B/N
MEAN=	2.33	9.73	###	3.42			MEAN=		1.05		2.28	3.32		0.289		
MEDIAN	2.20	9.70	###	4.20			MEDIAN		0.09		2.67	2.75		0.245		
STDDEV	0.42	8.11	###	1.66			STDDEV		1.67		1.73	3.18		0.308		
N	3	4	0	8			N		3		3	3		3		

TABLE 8B: Site RET-Microbiological Database

WELL: RET-1

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	0	0	0	0	LF	M
2/7/95					L	NO B/N
3/13/95	0.24	0.24	0.24	0.24	L	PF
4/13/95	0.24	0.24	0.5	1	H	PF
5/4/95	0.24	0.24	0.24	0.25	L	PF
5/31/95					L	NO B/N
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	0	0			LF	NO N, MPN
10/10/95					H	NO N/B
5/2/96					HF	NO B/N
GEOMEAN=	0.24	0.24	0.31	0.39		
STDEV	0.00	0.00	0.15	0.44		
COUNT	3.00	3.00	3.00	3.00		

WELL: RET-2

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/95	0	0	40	60	LF	M
2/7/95	21	21	22	6	L	S
3/13/95	0.75	0.75	20.25	0.24	L	PF
4/13/95	0.25	0.25	3.5	18.75	H	PF
5/4/95	17	16	7.5	0.24	L	PF
5/31/95					L	NO B/N
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	0	0		40	LF	NO N, MPN
10/10/95	0.24	0.24	18.25	0.24	H	PF
5/2/96	0.24	0.24	2.5	0.24	HF	PF
GEOMEAN=	0.71	0.70	7.53	0.57		
STDEV	7.44	6.99	8.32	8.28		
COUNT	5.00	5.00	5.00	5.00		

WELL: RET-3

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	0	0	0	0	LF	M
2/7/95					L	NO B/N
3/13/95	0.24	0.24	0.24	0.24	L	PF
4/13/95	0.24	0.24	3	2	H	PF
5/4/95	0.24	0.24	0.24	0.24	L	PF
5/31/95					L	NO B/N
6/12/95					HE	well bent
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	1400	0		16000	LF	NO N, MPN
10/10/95					H	NO B/N
5/2/96					HF	NO B/N
GEOMEAN=	0.24	0.24	0.56	0.49		
STDEV	0.00	0.00	1.59	1.02		
COUNT	3	3	3	3		

WELL: RET-4

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	0	0	0	0	LF	M
2/7/95	0	0	2	8	L	S, NO N
3/13/95	2.5	0.24	0.5	0.24	L	PF
4/13/95	0.24	0.24	0.5	0.24	H	PF
5/4/95	0.24	0.24	0.75	0.24	L	PF
5/31/95	0.24	0.24	0.5	0.24	L	PF
6/12/95	0.24	0.24	0.5	0.24	HE	PF
7/5/95					L	NO B/N
7/18/95					LE	NO B
8/2/95	0	0		0	LF	NO N, MPN
10/10/95					H	no access
5/2/96					HF	NO B/N
GEOMEAN=	0.38	0.24	0.54	0.24		
STDEV	1.01	0.00	0.11	0.00		
COUNT	5.00	5.00	5.00	5.00		

WELL: RET-5

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	0	0	0	0	LF	M
2/7/95	0	0	0	0	L	S
3/13/95	0.24	0.24	0.24	0.24	L	PF
4/13/95	0.25	0.25	0.24	0.25	H	PF
5/4/95	8.75	6.75	0.5	0.24	L	PF
5/31/95	0.24	0.24	0.24	0.24	L	PF
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95				0	LF	NO N, MPN
10/10/95	0.09	0.09	0.09	0.09	H	PF
5/2/96	3.5	0.5	0.49	0.09	HF	PF
GEOMEAN=	0.58	0.40	0.26	0.17		
STDEV	3.48	2.65	0.16	0.08		
COUNT	6.00	6.00	6.00	6.00		

WELL: RET-6

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94					LF	NO WELL
2/7/95	0	0	0	0	L	S
3/13/95	0.24	0.24	0.24	0.24	L	PF
4/13/95	0.24	0.24	0.25	0.24	H	PF
5/4/95					L	NO B/N
5/31/95					L	NO B/N
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/2/95	20	0		40	LF	NO N, MPN
10/10/95					H	NO B/N
5/2/96	0.09	0.09			HF	NO B/N
GEOMEAN=	0.17	0.17	0.24	0.24		
STDEV	0.09	0.09	0.01	0.00		
COUNT	3	3	2	2		

TABLE 8C: Site RB-Nutrient Database

WELL: RB-1							WELL: RB-1	um	mg/L	um	mg/L	mg/L	um	mg/L		
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	%OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	10.00						12/7/94	21.79	0.31	27.49	0.38	0.69	0.46	0.036	LF	M
2/7/95							2/7/95								L	NO B/N
3/15/95	3.80	5.50	7.01		2.33	42.86	3/15/95	10.55	0.15	26.09	0.37	0.51	13.12	1.036	H	FF
4/18/95							4/18/95								L	NO B/N
5/31/95							5/31/95								L	NO B/N
6/6/95							6/6/95								E	NO B/N
6/12/95							6/12/95								HE	NO B/N
7/5/95							7/5/95								L	NO B/N
7/18/95							7/18/95								LE	NO B/N
8/23/95							8/23/95								H	BENT
10/10/95							10/10/95								H	BENT
3/12/96							3/12/96								L	BENT
MEAN=	6.90	5.50	7.01				MEAN=		0.23		0.38	0.60		0.536		
							MEDIAN		0.23		0.38	0.60		0.536		
							STDDEV		0.11		0.01	0.13		0.707		
							N		2		2	2		2		
WELL: RB-2							WELL: RB-2									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	%OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	13.00						12/7/94	12.89	0.18	41.61	0.58	0.76	0.17	0.013	LF	M
2/7/95							2/7/95								L	NO B/N
3/15/95	15.50	5.00	6.96	6.86	3.67	36.36	3/15/95	0.00	0.00	62.10	0.87	0.87	4.97	0.392	H	FF
4/18/95	23.00		7.01		9.20	15.22	4/18/95	0.28	0.00	28.25	0.40	0.40	1.37	0.108	L	FF
5/31/95	23.00	16.00	6.54	8.05	5.20	23.08	5/31/95	0.00	0.00	79.82	1.12	1.12	5.35	0.423	L	FF
6/6/95	29.00		6.87	8.45	192.40	3.43	6/6/95	1.83	0.03	39.82	0.56	0.58	1.02	0.080	E	FF
6/12/95	28.00		6.49	7.75	6.20	3.23	6/12/95	0.00	0.00	172.68	2.42	2.42	4.27	0.337	HE	FF
7/5/95	31.00	17.00	6.50	8.33	114.67	3.78	7/5/95	1.15	0.02	20.24	0.28	0.30	3.22	0.254	L	FF
7/18/95	31.00	16.00	7.07	7.65	209.33	12.58	7/18/95	1.15	0.02	31.76	0.44	0.46	2.89	0.228	LE	FF
8/23/95	31.00	22.00	6.89	8.41	13.40	25.37	8/23/95	0.48	0.01	25.46	0.36	0.36	0.19	0.015	H	FF
10/10/95	18.00	19.00		7.44			10/10/95	16.61	0.23	40.54	0.57	0.80	0.19	0.015	H	FF
3/12/96	22.00			8.05			3/12/96	0.00	0.00	796.75	11.15	11.15	6.55	0.517	L	FF
MEAN=	24.05	15.83	6.77	7.89			MEAN=		0.04		1.70	1.75		0.217		
							MEDIAN		0.01		0.57	0.76		0.228		
							STDDEV		0.08		3.19	3.18		0.182		
							N		11		11	11		11		

WELL: RB-3							WELL: RB-3									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	%OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	11.00						12/7/94	47.45	0.66	21.61	0.30	0.97	0.34	0.027	LF	M
2/7/95	16.50	1.20	6.99		18.40		2/7/95	1.08	0.02	101.05	1.41	1.43	0.01	0.000	L	S
3/15/95	21.00	5.00	6.64	6.83	1.33	50.00	3/15/95	3.52	0.05	25.16	0.35	0.40	14.80	1.169	H	FF
4/18/95	26.00		6.91		50.00	17.33	4/18/95	1.82	0.03	24.23	0.34	0.36	0.12	0.009	L	NO B
5/31/95	24.00	19.00	6.64	8.02	7.80	17.95	5/31/95	0.05	0.00	17.54	0.25	0.25	1.91	0.151	L	NO B
6/6/95				8.35			6/6/95								E	NO B/N
6/12/95	24.00		6.61	7.66	6.60	12.12	6/12/95	0.85	0.01	45.56	0.64	0.65	2.41	0.190	HE	FF
7/5/95		23.00		8.29			7/5/95								L	NO B/N
7/18/95	31.00	17.50	7.04	7.59	6.20	25.81	7/18/95	10.17	0.14	20.31	0.28	0.43	3.34	0.264	LE	FF
8/23/95				8.22			8/23/95								H	NO B/N
10/10/95				7.00			10/10/95								H	NO B/N
3/12/96				7.79			3/12/96								L	NO B/N
MEAN=	21.93	13.14	6.81	7.75			MEAN=		0.13		0.51	0.64		0.259		
							MEDIAN		0.03		0.34	0.43		0.151		
							STDDEV		0.24		0.42	0.42		0.414		
							N		7		7	7		7		
WELL: RB-4							WELL: RB-4									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	%OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	15.00						12/7/94	48.90	0.68	27.33	0.38	1.07	0.66	0.052	LF	M
2/7/95	18.50	2.00			7.90		2/7/95	0.80	0.01	122.92	1.72	1.73	0.08	0.006	L	S
3/15/95	15.50	4.50	6.49	4.57	13.67	26.83	3/15/95	0.00	0.00	55.16	0.77	0.77	9.23	0.729	H	FF
4/18/95	25.00		6.81		5.40	25.93	4/18/95	2.16	0.03	21.91	0.31	0.34	0.23	0.018	L	FF
5/31/95				7.55			5/31/95								L	NO B/N
6/6/95				8.21			6/6/95								E	NO B/N
6/12/95	26.00		6.74	7.30	7.60	10.53	6/12/95	0.17	0.00	90.11	1.26	1.26	0.47	0.037	HE	FF
7/5/95				8.09			7/5/95								L	NO B/N
7/18/95	31.00	20.00	7.01	7.17	47.20	15.68	7/18/95	0.85	0.01	26.76	0.37	0.39	0.10	0.008	LE	NO B
8/23/95				8.21			8/23/95								H	NO B/N
10/10/95				6.49			10/10/95								H	NO B/N
3/12/96				7.39			3/12/96								L	NO B/N
MEAN=	21.83	8.83	6.76	7.22			MEAN=		0.12		0.80	0.93		0.142		
							MEDIAN		0.01		0.58	0.92		0.028		
							STDDEV		0.28		0.58	0.54		0.288		
							N		6		6	6		6		

TABLE 8C: Site RB-Microbiological Database						
WELL: RB-1						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*0*	*0*	*LF*	*M*
2/7/95					L	NO B/N
3/15/95	0.24	0.24	0.24	0.24	H	PF
4/18/95					L	NO B/N
5/31/95					L	NO B/N
6/6/95					E	NO B/N
6/12/95					HE	NO B/N
7/5/95					L	NO B/N
7/18/95					LE	NO B/N
8/23/95					H	BENT
10/10/95					H	BENT
3/12/96					L	NO B/N
GEOMEAN=	**0.24**	**0.24**	**0.24**	**0.24**		
COUNT	**1**	**1**	**1**	**1**		
WELL: RB-2						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*65*		*830*	*0*	*LF*	*M*
2/7/95					L	NO B/N
3/15/95	0.25	0.25	0.75	0.24	H	PF
4/18/95	0.24	0.24	1	0.24	L	PF
5/31/95	0.5	0.5	0.25	0.24	L	PF
6/6/95	3	3	0.75	0.24	E	PF
6/12/95	0.5	0.5	3.75	0.24	HE	PF
7/5/95	0.75	0.75	3.25	0.24	L	PF
7/18/95	3.25	0.75	11	0.49	LE	PF
8/23/95	5.75	5.75	0.24	0.24	H	PF
10/10/95	1.25	0.75	0.25	0.24	H	PF
3/12/96					L	NO B
GEOMEAN=	**0.97**	**0.78**	**1.01**	**0.26**		
STDEV	**1.89**	**1.84**	**3.50**	**0.08**		
COUNT	**9.00**	**9.00**	**9.00**	**9.00**		
WELL: RB-3						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*0*	*875*	*LF*	*M*
2/7/95	*0*	*0*	*48*	*0*	*L*	*S*
3/15/95	0.09	0.09	0.25	0.09	H	PF
4/18/95					L	NO B
5/31/95					L	NO B
6/6/95					E	NO B/N
6/12/95	0.25	0.25	0.24	0.24	HE	PF
7/5/95					L	NO B/N
7/18/95	0.5	0.5	0.24	0.24	LE	PF
10/10/95					H	NO B/N
3/12/96					L	NO B/N
GEOMEAN=	**0.22**	**0.22**	**0.24**	**0.17**		
STDEV	**0.21**	**0.21**	**0.01**	**0.09**		
COUNT	**3**	**3**	**3**	**3**		
WELL: RB-4						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*60*	*245*	*LF*	*M*
2/7/95	*9*	*9*	*85*	*0*	*L*	*S*
3/15/95	2.5	2.5	0.24	0.24	H	PF
4/18/95	0.24	0.24	0.5	0.24	L	PF
5/31/95					L	NO B/N
6/6/95					E	NO B/N
6/12/95	0.5	0.25	1	0.24	HE	PF
7/5/95					L	NO B/N
7/18/95					LE	NO B
10/10/95					H	NO B/N
3/12/96					L	NO B/N
GEOMEAN=	**0.67**	**0.53**	**0.49**	**0.24**		
STDEV	**1.24**	**1.30**	**0.39**	**0.00**		
COUNT	**3**	**3**	**3**	**3**		

TABLE 8D: Site RH-Nutrient Database

WELL: RH-1							WELL: RH-1	um	mg/L	um	mg/L	mg/L	um	mg/L		
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	9.00						12/7/94	742.60	10.40	3.66	0.05	10.45	0.39	0.03	LF	M
2/9/95	11.00	6.50	7.31		23.60		2/9/95	202.85	2.84	698.59	9.78	12.62	0.22	0.02	L	S
3/15/95	6.50	6.20	7.22	3.24	8.00	20.83	3/15/95	81.66	1.14	6.33	0.09	1.23	6.34	0.50	H	FF
4/18/95	4.00		6.61		17.60	18.18	4/18/95	1,413.31	19.79	142.65	2.00	21.78	112.22	8.66	L	FF
5/24/95	10.00		7.40	8.16	82.00	14.63	5/24/95	753.50	10.55	76.96	1.08	11.63	3.67	0.29	H	FF
6/6/95	7.00		7.62	8.45	360.60	6.87	6/6/95	146.35	2.05	28.52	0.40	2.45	0.18	0.01	E	FF
6/14/95	6.00		7.40	7.95	189.00	11.24	6/14/95	226.45	3.17	23.33	0.33	3.50	2.45	0.19	LF	FF
7/10/95	6.00	19.00	7.47	8.15	17.40	24.14	7/10/95	1,238.67	17.34	43.88	0.61	17.96	0.42	0.03	HE	FF
7/24/95	13.00	21.50	7.12	7.98	68.00	10.29	7/24/95	909.90	12.74	40.60	0.57	13.31	1.07	0.08	E	FF
11/7/95	20.50	14.90	7.25	8.08			11/7/95	21.88	0.31	31.24	0.44	0.74	0.82	0.06	H	FF
2/20/96	14.50			7.76			2/20/96	45.43	0.64	47.07	0.66	1.30	0.32	0.03	HF	FF
3/12/96	15.00		6.24	8.42			3/12/96	25.90	0.36	57.50	0.81	1.17	2.76	0.22	LE	FF
4/26/96	14.00	12.90	7.08	7.92			4/26/96	36.19	0.51	93.24	1.31	1.81	0.09	0.01	LE	FF
5/28/96	14.00	17.80	5.26	8.51			5/28/96	0.00	0.00	107,87	1.51	1.51	1.06	0.08	E	FF
MEAN=	**10.75**	**14.11**	**7.02**	**7.69**			**MEAN=**		**5.84**		**1.40**	**7.25**		**0.745**		
MEDIAN	**10.50**	**14.90**	**7.24**	**8.08**			**MEDIAN**		**2.44**		**0.64**	**2.97**		**0.074**		
STDDEV	**4.64**	**5.98**	**0.66**	**1.50**			**STDDEV**		**6.91**		**2.47**	**7.19**		**2.341**		
N	**14**	**7**	**12**	**11**			**N**		**14**		**14**	**14**		**14**		

WELL: RH-2							WELL: RH-2									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94							12/7/94								LF	M, NO N
2/9/95	15.00	7.00			14.00		2/9/95	47.33	0.66	45.24	0.63	1.30	0.30	0.02	L	S
3/15/95	16.00	5.80	7.21	4.27	137.00	8.52	3/15/95	20.42	0.29	20.06	0.28	0.57	9.95	0.79	H	FF
4/18/95	13.00		7.15		12.60	22.22	4/18/95	16.33	0.23	29.16	0.41	0.64	0.83	0.07	L	FF
5/24/95				8.00			5/24/95								H	NO B/N
6/6/95	5.00		7.80	8.25	91.33	11.68	6/6/95	1,101.82	15.43	110.95	1.55	16.98	0.19	0.02	E	NO B
6/14/95	4.00	14.50	7.56	7.83	183.67	9.07	6/14/95	1,836.51	25.71	0.44	0.01	25.72	1.34	0.11	LF	NO B
7/10/95				8.10			7/10/95								HE	NO B/N
7/24/95				8.22			7/24/95								E	NO B/N
11/7/95	18.00	13.50	6.75	7.95			11/7/95	28.12	0.39	243.00	3.40	3.80	0.13	0.01	H	FF
2/20/96	10.00			7.76			2/20/96	17.29	0.24	115.06	1.61	1.85	0.50	0.04	HF	FF
3/12/96				8.40			3/12/96								LE	No, N
4/26/96	15.00	13.90	6.47	7.77			4/26/96	13.86	0.19	28.60	0.40	0.59	0.19	0.01	LE	FF
5/28/96	10.00	21.50	4.93	8.32			5/28/96	41.66	0.58	292.89	4.10	4.68	1.45	0.11	E	FF
MEAN=	**11.78**	**12.70**	**6.84**	**7.72**			**MEAN=**		**4.88**		**1.38**	**6.24**		**0.131**		
MEDIAN	**13.00**	**13.70**	**7.15**	**8.00**			**MEDIAN**		**0.39**		**0.63**	**1.85**		**0.039**		
STDDEV	**4.89**	**5.71**	**0.95**	**1.16**			**STDDEV**		**9.27**		**1.46**	**8.96**		**0.249**		
N	**9**	**6**	**7**	**11**			**N**		**9**		**9**	**9**		**9**		

WELL: RH-3							WELL: RH-3									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/94	3.00						12/7/94	938.26	13.14	38.25	0.54	13.67	11.07	0.87	LF	M
2/9/95	11.50	8.00			19.20		2/9/95	113.87	1.59	24.47	0.34	1.94	0.25	0.02	L	S
3/15/95	17.40	7.00	7.19	7.41	7.00	14.29	3/15/95	75.34	1.05	19.72	0.28	1.33	14.06	1.11	H	FF
4/18/95	10.00		7.25		6.60	30.30	4/18/95	39.21	0.55	28.66	0.40	0.95	0.60	0.05	L	FF
5/24/95	10.00		7.48	8.13	18.80	16.67	5/24/95	53.73	0.75	36.87	0.52	1.27	1.07	0.08	H	FF
6/6/95	10.00		7.60	8.51	563.50	3.73	6/6/95	123.39	1.73	58.63	0.82	2.55	0.18	0.01	E	NO B
6/14/95	8.00	14.00	7.53	7.97	102.00	2.75	6/14/95	207.69	2.91	0.00	0.00	2.91	4.45	0.35	LF	FF
7/10/95	12.00	17.50	7.57	8.32	21.00	21.90	7/10/95	0.00	0.00	76.51	1.07	1.07	0.09	0.01	HE	FF
7/24/95	19.00	21.50	7.46	8.55	34.00	17.06	7/24/95	0.00	0.00	56.29	0.79	0.79	0.41	0.03	E	FF
11/7/95	20.00	11.80	7.20				11/7/95	19.66	0.28	81.35	1.14	1.41	0.07	0.01	H	FF
2/20/96	16.20			7.90			2/20/96	0.00	0.00	44.01	0.62	0.62	1.09	0.09	HF	FF
3/12/96	15.00			8.53			3/12/96	0.00	0.00	38.26	0.54	0.54	0.60	0.05	LE	FF
4/26/96	12.00	11.00	5.98	7.93			4/26/96	10.20	0.14	46.33	0.65	0.79	0.23	0.02	LE	FF
5/28/96	11.00	16.50	5.30	8.60			5/28/96	9.02	0.13	117.29	1.64	1.77	0.64	0.05	E	FF
MEAN=	**12.51**	**13.41**	**7.06**	**8.19**			**MEAN=**		**1.59**		**0.67**	**2.26**		**0.196**		
MEDIAN	**11.75**	**12.90**	**7.36**	**8.23**			**MEDIAN**		**0.41**		**0.58**	**1.30**		**0.047**		
STDDEV	**4.60**	**4.94**	**0.78**	**0.39**			**STDDEV**		**3.43**		**0.41**	**3.36**		**0.351**		
N	**14**	**8**	**10**	**10**			**N**		**14**		**14**	**14**		**14**		

WELL: RH-4							WELL: RH-4									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/95							12/7/95								LF	NO WELL
2/9/95	14.00	8.00			23.30		2/9/95	65.96	0.92	112.81	1.58	2.50	10.25	0.81	L	S
3/15/95	13.10	8.00	7.43	4.96	298.00	51.01	3/15/95	16.51	0.23	35.53	0.50	0.73	31.89	2.52	H	FF
4/18/95	12.00		7.79		121.50	16.87	4/18/95	134.12	1.88	73.95	1.04	2.91	0.27	0.02	L	FF
5/24/95				7.18			5/24/95								H	NO B/N
6/6/95				7.60	41.40	9.66	6/6/95								E	NO B/N
6/14/95		15.50		7.04			6/14/95								LF	NO B/N
7/10/95				7.36			7/10/95								HE	NO B/N
7/24/95				7.37			7/24/95								E	NO B/N
11/7/95	20.00	11.80	7.50				11/7/95	8.07	0.11	114.85	1.61	1.72	0.14	0.01	H	FF
2/20/96	23.50	7.80		7.00			2/20/96	10.05	0.14	61.87	0.87	1.01	0.58	0.05	HF	FF
3/12/96	24.00		6.81	7.70			3/12/96	7.64	0.11	246.48	3.45	3.56	0.39	0.03	L	FF
4/26/96	27.00	11.10	7.28	7.21			4/26/96	4.07	0.06	83.36	1.17	1.22	0.20	0.02	LE	FF
5/28/96	18.00	15.50	7.24	7.74			5/28/96	1.65	0.02	65.83	0.92	0.94	0.42	0.03	E	FF
MEAN=	**18.95**	**11.10**	**7.34**	**7.12**			**MEAN=**		**0.43**		**1.39**	**1.82**		**0.436**		
MEDIAN	**19.00**	**11.10**	**7.36**	**7.29**			**MEDIAN**		**0.13**		**1.10**	**1.47**		**0.032**		
STDDEV	**5.61**	**3.40**	**0.33**	**0.60**			**STDDEV**		**0.65**		**0.91**	**1.05**		**0.885**		
N	**8**	**7**	**6**	**10**			**N**		**8**		**8**	**8**		**8**		

RH-5DEEP							RH-5DEEP									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
12/7/95							12/7/95								LF	NO WELL
2/9/95	4.00	10.00					2/9/95								L	S, NO N
3/15/95	11.50	8.00	7.17	6.38	10.67	25.00	3/15/95	5.00	0.07	134.79	1.89	1.96	72.53	5.73	H	FF
4/18/95	2.00		7.46		58.00	25.86	4/18/95	0.00	0.00	163.92	2.29	2.29	0.17	0.01	L	FF
5/24/95	2.00		7.29	7.47	13.33	12.50	5/24/95	5.54	0.08	167.41	2.34	2.42	18.97	1.50	H	FF
6/6/95	3.00		7.45	10.78			6/6/95	0.44	0.01	254.78	3.57	3.57	79.28	6.26	E	FF
6/14/95	4.00	12.00	7.23	11.31	8.40	21.43	6/14/95	1.75	0.02	8.58	0.12	0.14	25.75	2.03	LF	FF
7/10/95	4.00	15.50	7.53	7.00	204.00	11.27	7/10/95	0.00	0.00	214.45	3.00	3.00	0.27	0.02	HE	FF
7/24/95	5.00	16.00	7.46	7.96	162.50	6.03	7/24/95	0.65	0.01	56.91	0.80	0.81	14.96	1.16	E	FF
11/7/95			7.23				11/7/95	10.73	0.15	213.97	3.00	3.15	25.03	1.98	H	FF
2/20/96	2.50	8.20		9.90			2/20/96	3.79	0.05	97.09	1.36	1.41	0.77	0.06	HF	FF
3/12/96				10.32			3/12/96								LE	NO B/N
4/26/96		10.20		9.36			4/26/96								LE	NO B/N
5/28/96		17.50		9.79			5/28/96								E	NO B/N
MEAN=	**4.22**	**12.18**	**7.35**	**9.03**			**MEAN=**		**0.04**		**2.04**	**2.08**		**2.088**		
MEDIAN	**4.00**	**11.10**	**7.37**	**9.58**			**MEDIAN**		**0.02**		**2.29**	**2.29**		**1.498**		
STDDEV	**2.92**	**3.70**	**0.14**	**1.70**			**STDDEV**		**0.05**		**1.12**	**1.13**		**2.359**		
N	**9**	**8**	**8**	**10**			**N**		**9**		**9**	**9**		**9**		

TABLE 8D: Site RH-Microbiological Database						
WELL: RH-1						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*5*		*35*	*285*	*LF*	*M*
2/9/95	*TNTC*	*TNTC*	*203*	*130*	*L*	*S*
3/15/95	230	220	2.5	0.24	H	FF
4/18/95	7.75	6.5	26.75	0.24	L	FF
5/24/95	1	1	0.24		H	FF
6/6/95	1.5	1.5	2	0.49	E	FF
6/14/95	0.5	0.5	0.25	0.24	LF	FF
7/10/95	139	125	5.25	0.24	HE	FF
7/24/95	18950	17900	1.5	0.49	E	FF
11/7/95	1.5	1.5	0.24	0.24	H	FF
2/20/96	28.5	20	4	0.09	HF	FF
4/25/96	125	110	0.25	0.24	LE	FF
5/28/96	4.5	4	7	0.24	LE	FF
GEOMEAN=	**18.46**	**16.88**	**1.53**	**0.25**		
STDEV	**5697.90**	**5382.77**	**7.71**	**0.12**		
COUNT	**11**	**11**	**11**	**10**		
WELL: RH-2						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*350*	*10*	*LF*	*M, NO N*
2/9/95	*0*	*0*	*3*	*0*	*L*	*S*
3/15/95	0.24	0.24	0.24	0.24	H	FF
4/18/95	0.24	0.24	0.24	0.24	L	FF
5/24/95					H	NO B/N
6/6/95					E	NO B
6/14/95					LF	NO B
7/10/95					HE	NO B/N
7/24/95					E	NO B/N
11/7/95	0.24	0.24	0.5	0.24	H	FF
2/20/96					HF	NO B
4/25/96	0.49	0.49			LE	FF
5/28/96	0.09	0.09			LE	FF
GEOMEAN=	**0.23**	**0.23**	**0.31**	**0.24**		
STDEV	**0.14**	**0.14**	**0.15**	**0.00**		
COUNT	**5**	**5**	**3**	**3**		
WELL: RH-3						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/94	*0*	*0*	*10*	*145*	*LF*	*M*
2/9/95	*28*	*24*	*0*	*0*	*L*	*S*
3/15/95	505	470	3.5	0.24	H	FF
4/18/95	1.5	1.5	0.5	0.24	L	FF
5/24/95	0.24	0.24	0.24		H	FF
6/6/95					E	NO B
6/14/95	1	1	0.24	0.24	LF	FF
7/10/95	0.24	0.24	4.5	0.24	HE	FF
7/24/95	2	1.5	0.24	0.24	E	FF
11/7/95	0.24	0.24	0.75	0.24	H	FF
2/20/96					HF	NO B
4/25/96	0.49	0.49			LE	FF
5/28/96	0.09	0.09			LE	FF
GEOMEAN=	**0.99**	**0.95**	**0.70**	**0.24**		
STDEV	**168.09**	**156.45**	**1.79**	**0.00**		
COUNT	**9**	**9**	**7**	**6**		
WELL: RH-4						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/95					LF	NO WELL
2/9/95	*18*	*11*	*61*	*0*	*L*	*S*
3/15/95	1.25	1	0.24	0.24	H	FF
4/18/95	0.5	0.5	0.5	0.24	L	FF
5/24/95					H	NO B/N
6/6/95					E	NO B/N
6/14/95					LF	NO B/N
7/10/95					HE	NO B/N
7/24/95					E	NO B/N
11/7/95	0.24	0.24	0.24	0.24	H	FF
2/20/96	0.24	0.24	0.24	0.24	HF	FF
4/25/96	0.24	0.24	0.24	0.24	LE	FF
5/28/96	0.24	0.24	0.24	0.24	LE	FF
GEOMEAN=	**0.36**	**0.34**	**0.27**	**0.24**		
STDEV	**0.40**	**0.31**	**0.11**	**0.00**		
COUNT	**6**	**6**	**6**	**6**		
RH -5DEEP						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
12/7/95					LF	NO WELL
2/9/95	*0*	*0*	*134*	*0*	*L*	*S, NO N*
3/15/95	0.49	0.49	0.49	0.49	H	FF
4/18/95	0.24	0.24	0.5	0.24	L	FF
5/24/95	0.24	0.24	0.24		H	FF
6/6/95	0.24	0.24	0.24	0.24	E	FF
6/14/95	0.24	0.24	0.25	0.24	LF	FF
7/10/95	0.24	0.24	0.24	0.24	HE	FF
7/24/95	0.24	0.24	0.24	0.24	E	FF
11/7/95	0.49	0.49	0.49	0.49	H	FF
2/20/96					HF	NO B
4/25/96					LE	NO B/N
5/28/96					LE	NO SAMPLE
GEOMEAN=	**0.29**	**0.29**	**0.32**	**0.29**		
STDEV	**0.12**	**0.12**	**0.13**	**0.12**		
COUNT	**8**	**8**	**8**	**7**		

TABLE 8E: Site RP-Nutrient Database

WELL: RP-1							WELL: RP-1								
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	10.00	10.00			26.40		1/16/95	725.80	10.16	30.09	0.42	10.58	0.16	0.01	H	M
2/9/95	7.50	8.00			32.70		2/9/95	986.95	13.82	21.90	0.31	14.12	0.27	0.02	L	S
3/15/95	5.50	7.00	7.04	6.75	6.67	40.00	3/15/95	23.77	0.33	32.24	0.45	0.78	3.99	0.31	H	FF
4/20/95	3.00		7.32				4/20/95	50.37	0.71	26.19	0.37	1.07	0.67	0.05	L	FF
5/18/95	8.00		7.13	7.21	20.00	15.00	5/18/95	0.32	0.00	39.20	0.55	0.55	4.91	0.39	L	FF
5/24/95	6.00		7.33	7.55	10.40	25.00	5/24/95	1.47	0.02	36.53	0.51	0.53	1.43	0.11	H	FF
6/14/95	12.00	12.00	7.14	7.42	53.40	5.62	6/14/95	5.14	0.07	45.51	0.64	0.71	11.30	0.89	LF	FF
7/10/95	13.00	17.50	7.26	7.74	691.50	19.96	7/10/95	0.46	0.01	126.80	1.78	1.78	0.13	0.01	HE	FF
7/24/95	13.00	21.50	7.82	7.98	25.80	18.60	7/24/95	0.89	0.01	51.17	0.72	0.73	0.66	0.05	E	NO B
11/7/95	21.00		7.38				11/7/95	33.48	0.47	28.06	0.39	0.86	2.64	0.21	H	FF
12/5/95	17.00		7.15	7.50			12/5/95	6.39	0.09	68.11	0.95	1.04	0.21	0.02	HF	FF
4/23/96	19.00		7.01	7.30			4/23/96	4.55	0.06	176.75	2.47	2.54	0.25	0.02	L	FF
MEAN=	**11.25**	**12.67**	**7.26**	**7.43**			**MEAN=**		**2.15**		**0.80**	**2.94**		**0.175**		
MEDIAN	**11.00**	**11.00**	**7.21**	**7.46**			**MEDIAN**		**0.08**		**0.53**	**0.95**		**0.052**		
STDDEV	**5.64**	**5.71**	**0.23**	**0.37**			**STDDEV**		**4.67**		**0.66**	**4.50**		**0.260**		
N	**12**	**6**	**10**	**8**			**N**		**12**		**12**	**12**		**12**		

WELL: RP-2							WELL: RP-2								
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	13.00	8.90			28.10		1/16/95	201.35	2.82	102.54	1.44	4.25	1.74	0.14	H	M
2/9/95	11.00	6.00	7.19		23.10		2/9/95	39.96	0.56	54.45	0.76	1.32	0.08	0.01	L	S
3/15/95	6.80	5.40	7.12	3.51	6.33	31.58	3/15/95	9.97	0.14	14.23	0.20	0.34	12.84	1.01	H	FF
4/20/95	3.00		7.32				4/20/95	1.42	0.02	29.51	0.41	0.43	0.37	0.03	L	FF
5/18/95	4.00		7.17	7.90	25.20	14.29	5/18/95	6.30	0.09	26.94	0.38	0.47	1.92	0.15	L	FF
5/24/95	7.00		7.30	8.43	9.60	18.75	5/24/95	6.76	0.09	43.04	0.60	0.70	3.90	0.31	H	FF
6/14/95	10.00	12.00	7.36	8.42	150.20	3.33	6/14/95	1.76	0.02	91.35	1.28	1.30	0.74	0.06	LF	FF
7/10/95			7.00	8.38			7/10/95								HE	NO B/N
7/24/95				8.67			7/24/95								E	NO SAMPLE
11/7/95	11.00		7.26				11/7/95	59.98	0.84	52.22	0.73	1.57	0.11	0.01	H	FF
12/5/95	11.00		6.21	8.32			12/5/95	3.21	0.04	81.85	1.15	1.19	1.13	0.09	HF	FF
4/23/96				8.18			4/23/96								L	NO B/N
MEAN=	**8.53**	**8.08**	**7.10**	**7.73**			**MEAN=**		**0.51**		**0.77**	**1.29**		**0.200**		
MEDIAN	**10.00**	**7.45**	**7.19**	**8.35**			**MEDIAN**		**0.09**		**0.73**	**1.19**		**0.089**		
STDDEV	**3.48**	**3.03**	**0.35**	**1.72**			**STDDEV**		**0.91**		**0.43**	**1.20**		**0.319**		
N	**9**	**4**	**9**	**8**			**N**		**9**		**9**	**9**		**9**		

WELL: RP-3							WELL: RP-3								
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	8.80	9.90	7.44		12.60		1/16/95	74.50	1.04	20.86	0.29	1.34	1.22	0.10	H	M
2/9/95	7.50	6.00			26.90		2/9/95	105.72	1.48	34.34	0.48	1.96	0.08	0.01	L	S
3/15/95	6.50	6.00	7.15	7.82	6.00	27.78	3/15/95	8.87	0.12	224.64	3.14	3.27	1.02	0.08	H	FF
4/20/95	5.00		7.42				4/20/95	226.09	3.17	703.97	9.86	13.02	1.42	0.11	L	FF
5/18/95	6.00		7.25	8.30	301.00	16.28	5/18/95	85.16	1.19	24.03	0.34	1.53	0.75	0.06	L	FF
5/24/95	5.00		7.22	9.11	10.80	16.67	5/24/95	46.96	0.66	42.81	0.60	1.26	7.84	0.62	H	FF
6/14/95	6.00	10.50	7.27	8.54	4.60	26.09	6/14/95	421.17	5.90	46.45	0.65	6.55	13.84	1.09	LF	FF
7/10/95	5.00	19.00	7.57	8.76	26.20	6.11	7/10/95	327.19	4.58	27.59	0.39	4.97	0.17	0.01	HE	FF
7/24/95				9.07			7/24/95								E	NO SAMPLE
11/7/95	20.00		7.14				11/7/95	25.66	0.36	54.18	0.76	1.12	1.01	0.08	H	FF
12/5/95	17.00		6.49	8.37			12/5/95	3.81	0.05	23.02	0.32	0.38	0.48	0.04	HF	FF
4/23/96	14.00		5.93	8.30			4/23/96	59.15	0.83	97.64	1.37	2.20	0.47	0.04	L	FF
MEAN=	**9.16**	**10.28**	**7.09**	**8.41**			**MEAN=**		**1.76**		**1.65**	**3.42**		**0.203**		
MEDIAN	**6.50**	**9.90**	**7.24**	**8.34**			**MEDIAN**		**1.04**		**0.60**	**1.96**		**0.080**		
STDDEV	**5.33**	**5.31**	**0.50**	**0.39**			**STDDEV**		**1.94**		**2.84**	**3.68**		**0.341**		
N	**11**	**5**	**10**	**8**			**N**		**11**		**11**	**11**		**11**		

WELL: RP-4							WELL: RP-4								
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	16.90	9.10			16.30		1/16/95	75.48	1.06	116.97	1.64	2.69	0.83	0.07	H	M
2/9/95	8.00	6.00			24.70		2/9/95	70.56	0.99	52.13	0.73	1.72	0.04	0.00	L	S
3/15/95	13.90	6.80	7.19	7.19	7.00	23.81	3/15/95	12.37	0.17	19.57	0.27	0.45	4.33	0.34	H	FF
4/20/95	5.00		7.35				4/20/95	23.92	0.33	38.42	0.54	0.87	1.85	0.15	L	FF
5/18/95	8.00		7.06	7.55	9.20	21.74	5/18/95	21.74	0.30	57.61	0.81	1.11	14.26	1.13	L	FF
5/24/95	10.00		7.07	7.38	7.00	25.71	5/24/95	2.29	0.03	58.40	0.82	0.85	7.32	0.58	H	FF
6/14/95	12.00	10.50	7.00	8.04	11.50	17.39	6/14/95	7.87	0.11	30.32	0.42	0.53	18.13	1.43	LF	FF
7/10/95	14.00	15.20	7.35	8.15	28.00	19.29	7/10/95	25.05	0.35	124.06	1.74	2.09	0.10	0.01	HE	FF
7/24/95	13.00	17.00	7.56	8.46	41.20	19.90	7/24/95	8.43	0.12	45.36	0.64	0.75	3.24	0.26	E	FF
11/7/95	20.00		7.20				11/7/95	13.05	0.18	141.53	1.98	2.16	5.83	0.46	H	FF
12/5/95	20.00		7.12	8.10			12/5/95	5.47	0.08	66.89	0.94	1.01	0.79	0.06	HF	FF
4/23/96	21.00	15.00	6.61	7.79			4/23/96	3.05	0.04	70.77	0.99	1.03	0.23	0.02	L	FF
MEAN=	**13.48**	**11.37**	**7.15**	**7.83**			**MEAN=**		**0.31**		**0.96**	**1.27**		**0.375**		
MEDIAN	**13.45**	**10.50**	**7.16**	**7.92**			**MEDIAN**		**0.18**		**0.81**	**1.02**		**0.201**		
STDDEV	**5.22**	**4.38**	**0.25**	**0.43**			**STDDEV**		**0.35**		**0.54**	**0.72**		**0.466**		
N	**12**	**7**	**10**	**8**			**N**		**12**		**12**	**12**		**12**		

WELL: RP-5 DEEP							WELL: RP-5 DEEP									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	7.70	10.90			3.30		1/16/95	0.00	0.00	278.58	3.90	3.90	105.79	8.36	H	M
2/9/95							2/9/95								L	NO B/N
3/15/95	8.50	8.20	7.27		73.33	20.00	3/15/95	5.16	0.07	141.74	1.98	2.06	22.50	1.78	H	FF
4/20/95							4/20/95								L	NO B/N
5/18/95	5.00		7.21	11.20	320.00	15.63	5/18/95	0.81	0.01	367.24	5.14	5.15	50.85	4.02	L	FF
5/24/95	6.00		7.20	8.65	36.00	8.33	5/24/95	1.50	0.02	206.96	2.90	2.92	17.51	1.38	H	FF
6/14/95	4.00	10.50	7.29	10.74	34.00	25.88	6/14/95	9.74	0.14	0.00	0.00	0.14	29.96	2.37	LF	FF
7/10/95	5.00	13.00	7.85	6.98	309.50	15.19	7/10/95	1.67	0.02	198.87	2.78	2.81	0.14	0.01	HE	FF
7/24/95	4.00	16.00	7.76	8.35	114.67	18.60	7/24/95	1.46	0.02	35.98	0.50	0.52	4.32	0.34	E	FF
11/7/95	3.00		7.16				11/7/95	0.22	0.00	165.34	2.31	2.32	0.24	0.02	H	FF
12/5/95	3.00		7.63	6.27			12/5/95	5.54	0.08	133.95	1.88	1.95	1.07	0.08	HF	FF
4/23/96	2.00	17.00	7.49	9.55			4/23/96	4.07	0.06	24.67	0.35	0.40	0.20	0.02	L	FF
MEAN=	**4.82**	**12.60**	**7.43**	**8.82**			**MEAN=**		**0.04**		**2.17**	**2.22**		**1.837**		
MEDIAN	**4.50**	**11.95**	**7.29**	**8.65**			**MEDIAN**		**0.02**		**2.15**	**2.19**		**0.862**		
STDDEV	**2.09**	**3.40**	**0.26**	**1.83**			**STDDEV**		**0.04**		**1.62**	**1.59**		**2.646**		
N	**10**	**6**	**9**	**7**			**N**		**10**		**10**	**10**		**10**		

WELL: RP/RC-1							WELL: RP/RC-1									
DATE	SAL	TEMP	pH	H20 DEPTH	NO3	NO3-N	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/23/96	19	16	7.12	3.19			4/23/96	5.44	0.076	15.74	0.2204	0.2965	2.87	0.2267	L	FF
5/28/96	6	14	7.35	5.5			5/28/96	0	0	117.51	1.6451	1.6451	15.79	1.2472	E	FF
MEAN=	**12.5**	**15**	**7.24**	**4.345**			**MEAN=**		**0.038**		**0.93**	**0.97**		**0.7369**		
MEDIAN							**MEDIAN**		**0.038**		**0.93**	**0.97**		**0.7369**		
STDDEV							**STDDEV**		**0.054**		**1.01**	**0.95**		**0.7216**		
N							**N**		**2**		**2**	**2**		**2**		

WELL: RP/RC-2							WELL: RP/RC-2									
DATE	SAL	TEMP	pH	H20 DEPTH	NO3	NO3-N	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/23/96	12	14	7.28	5.1			4/23/96	6.82	0.095	60.53	0.8474	0.9429	1.235	0.0975	L	FF
5/28/96	8	14.5	7.29	4.95			5/28/96	0	0	19.37	0.2712	0.2712	9.827	0.7761	E	FF
MEAN=	**10**	**14.25**	**7.29**	**5.025**			**MEAN=**		**0.048**		**0.56**	**0.61**		**0.4368**		
MEDIAN							**MEDIAN**		**0.048**		**0.56**	**0.61**		**0.4368**		
STDDEV							**STDDEV**		**0.068**		**0.41**	**0.47**		**0.4798**		
N							**N**		**2**		**2**	**2**		**2**		

WELL: RP/RC-3							WELL: RP/RC-3									
DATE	SAL	TEMP	pH	H20 DEPTH	NO3	NO3-N	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/23/96	10	13	7.07	3.1			4/23/96	5.23	0.073	16.95	0.2373	0.3105	5.04	0.3981	L	FF
5/28/96	13	15.1	7.27	3.07			5/28/96	1.72	0.024	32.64	0.457	0.481	1.442	0.1139	E	FF
MEAN=	**11.5**	**14.05**	**7.17**	**3.085**			**MEAN=**		**0.049**		**0.35**	**0.40**		**0.256**		
MEDIAN							**MEDIAN**		**0.049**		**0.35**	**0.40**		**0.256**		
STDDEV							**STDDEV**		**0.035**		**0.16**	**0.12**		**0.2009**		
N							**N**		**2**		**2**	**2**		**2**		

WELL: RP/RC-4							WELL: RP/RC-4									
DATE	SAL	TEMP	pH	H20 DEPTH	NO3	NO3-N	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/23/96	6	12	7.29	5.59			4/23/96	6.25	0.088	229.24	3.2093	3.2968	9.539	0.7534	L	FF
5/28/96	22	14.7	7.33	3.18			5/28/96	1.08	0.015	26.34	0.3688	0.3839	1.361	0.1075	E	FF
MEAN=	**14**	**13.35**	**7.31**	**4.385**			**MEAN=**		**0.051**		**1.79**	**1.84**		**0.430**		
MEDIAN							**MEDIAN**		**0.051**		**1.79**	**1.84**		**0.430**		
STDDEV							**STDDEV**		**0.051**		**2.01**	**2.06**		**0.457**		
N							**N**		**2**		**2**	**2**		**2**		

TABLE 8E: Site RP-Microbiological Database

WELL: RP-1						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	*10*	*10*	*5*	*60*	*H*	*M*
2/9/95	*0*	*0*	*0*	*0*	*L*	*S*
3/15/95	71	42	0.24	0.24	H	FF
4/20/95	0.25	0.24	0.24	0.24	L	FF
5/18/95	0.24	0.24	0.24	0.24	L	FF
5/24/95	0.24	0.24	0.24	0.24	H	FF
6/14/95	0.25	0.25	0.24	0.24	LF	FF
7/10/95	0.24	0.24	0.24	0.24	HE	FF
7/24/95					E	NO B
11/7/95	0.24	0.24	0.24	0.24	H	FF
12/5/95	0.24	0.24	0.24	0.24	HF	FF
4/23/96	0.49	0.49	0.49	0.49	L	FF
GEOMEAN=	**0.49**	**0.46**	**0.26**	**0.26**		
STDEV	**23.58**	**13.91**	**0.08**	**0.08**		
COUNT	**9**	**9**	**9**	**9**		

WELL: RP-2						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	*0*	*0*	*18*	*10*	*H*	*M*
2/9/95	*0*	*0*	*1*	*0*	*L*	*S*
3/15/95	0.24	0.24	0.5	0.24	H	FF
4/20/95	0.24	0.24	0.24	0.24	L	FF
5/18/95	0.24	0.24	0.24	0.24	L	FF
5/24/95	0.24	0.24	0.24	0.24	H	FF
6/14/95	0.75	0.75	0.24	0.24	LF	FF
7/10/95					HE	NO B/N
7/24/95					E	NO SAMPLE
11/7/95	0.09	0.09	0.09	0.09	H	FF
12/5/95					HF	NO B
4/23/96					L	NO SAMPLE
GEOMEAN=	**0.25**	**0.25**	**0.23**	**0.20**		
STDEV	**0.23**	**0.23**	**0.13**	**0.06**		
COUNT	**6**	**6**	**6**	**6**		

WELL: RP-3						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	*0*	*0*	*100*	*0*	*H*	*M*
2/9/95	*0*	*0*	*0*	*0*	*L*	*S*
3/15/95	0.49	0.49	0.49	0.49	H	FF
4/20/95	0.24	0.24	0.24	0.25	L	FF
5/18/95	0.24	0.24	0.24	0.24	L	FF
5/24/95	0.24	0.24	0.24	0.24	H	FF
6/14/95	0.25	0.25	0.25	0.24	LF	FF
7/10/95	0.24	0.24	8.25	0.24	HE	FF
7/24/95					E	NO SAMPLE
11/7/95	0.24	0.24	0.24	0.24	H	FF
12/5/95	0.24	0.24	0.25	0.24	HF	FF
4/23/96	0.49	0.49			L	FF
GEOMEAN=	**0.28**	**0.28**	**0.41**	**0.26**		
STDEV	**0.11**	**0.11**	**2.82**	**0.09**		
COUNT	**9**	**9**	**8**	**8**		

WELL: RP-4						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	*0*	*0*	*0*	*8*	*H*	*M*
2/9/95	*0*	*0*	*0*	*0*	*L*	*S*
3/15/95	0.24	0.24	0.24	0.24	H	FF
4/20/95	0.24	0.24	0.25	0.24	L	FF
5/18/95	0.25	0.25	0.24	0.24	L	FF
5/24/95	0.24	0.24	0.24		H	FF
6/14/95	0.24	0.24	0.24	0.24	LF	FF
7/10/95	0.24	0.24	0.24	0.24	HE	FF
7/24/95	0.24	0.24	0.24	0.24	E	FF
11/7/95	0.24	0.24	0.24	0.24	H	FF
12/5/95	0.24	0.24	0.24	0.24	HF	FF
4/23/96	0.24	0.24	0.24	0.24	L	FF
GEOMEAN=	**0.24**	**0.24**	**0.24**	**0.24**		
STDEV	**0.00**	**0.00**	**0.00**	**0.00**		
COUNT	**10**	**10**	**10**	**9**		

WELL: RP-5 DEEP						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	*0*	*0*	*0*	*0*	*H*	*M*
2/9/95					L	NO B/N
3/15/95	0.24	0.24	0.24	0.24	H	FF
4/20/95					L	NO B/N
5/18/95	0.24	0.24	0.24	0.24	L	FF
5/24/95	0.24	0.24	0.24		H	FF
6/14/95	0.25	0.25	0.24	0.24	LF	FF
7/10/95	0.25	0.24		0.24	HE	FF
7/24/95	0.24	0.24	0.24	0.24	E	FF
11/7/95	0.49	0.49	0.49	0.49	H	FF
12/5/95	0.24	0.24	0.24	0.24	HF	FF
4/23/96	0.24	0.24	0.24	0.24	L	FF
GEOMEAN=	**0.26**	**0.26**	**0.26**	**0.26**		
STDEV	**0.08**	**0.08**	**0.09**	**0.09**		
COUNT	**9**	**9**	**8**	**8**		

WELL: RP/RC-1						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
4/23/96	0.24	0.24	0.24	0.24	L	FF
5/28/96	0.24	0.24	0.24	0.24	LE	FF
GEOMEAN=	**0.24**	**0.24**	**0.24**	**0.24**		
COUNT	**2**	**2**	**2**	**2**		

WELL: RP/RC-2						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
4/23/96	0.24	0.24	0.24	0.24	L	FF
5/28/96	0.24	0.24	0.5	0.24	LE	FF
GEOMEAN=	**0.24**	**0.24**	**0.35**	**0.24**		
COUNT	**2**	**2**	**2**	**2**		

WELL: RP/RC-3						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
4/23/96	0.24	0.24	0.24	0.24	L	FF
5/28/96	0.24	0.24	0.24	0.24	LE	FF
GEOMEAN=	**0.24**	**0.24**	**0.24**	**0.24**		
COUNT	**2**	**2**	**2**	**2**		

WELL: RP/RC-4						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
4/23/96	0.24	0.24	0.24	0.24	L	FF
5/28/96	0.24	0.24	0.24	0.24	LE	FF
GEOMEAN=	0.24	0.24	0.24	0.24		
COUNT	2	2	2	2		

TABLE 8F: Site RC-Nutrient Database																
WELL: RC-1 DEEP							WELL: RC-1 DE	um	mg/L	um	mg/L	mg/L	um	mg/L		
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	8.80	11.00			22.50		1/16/95	1071.87	15.01	1167.06	16.34	31.35	7.38	0.58	H	S
2/9/95	9.50	8.00	7.09		24.70		2/9/95	139.22	1.95	1193.34	16.71	18.66	0.16	0.01	L	S
3/23/95	10.00		6.92	9.21	20.60	10.68	3/23/95	31.01	0.43	837.91	11.73	12.16	1.16	0.09	L	FF
4/20/95	6.00		6.99				4/20/95	1285.62	18.00	644.29	9.02	27.02	61.17	4.83	L	FF
5/18/95	6.00		7.02	9.00	24.80	15.32	5/18/95	217.84	3.05	612.42	8.57	11.62	5.59	0.44	L	FF
5/24/95	6.00		7.02	10.15	12.60	12.70	5/24/95	135.15	1.89	492.77	6.90	8.79	5.10	0.40	H	FF
6/14/95	5.00	11.90	6.88	10.03	26.60	5.26	6/14/95	39.86	0.56	8.98	0.13	0.68	12.97	1.02	LF	FF
7/10/95	9.00	13.50	7.18	10.34	22.60	17.70	7/10/95	2.27	0.03	203.50	2.85	2.88	50.21	3.97	HE	FF
8/23/95	6.00	16.20	7.21	9.13	64.50	26.36	8/23/95	0.48	0.01	18.99	0.27	0.27	13.39	1.06	H	FF
11/16/95	26.00			9.34			11/16/95	35.89	0.50	139.96	1.96	2.46	6.88	0.54	HF	FF
12/5/95	20.50		6.95	10.20			12/5/95	463.07	6.48	307.75	4.31	10.79	1.28	0.10	HF	FF
3/12/96	18.00	4.00	7.01	10.42			3/12/96	641.14	8.98	54.50	0.76	9.74	0.34	0.03	LE	FF
4/26/96	21.00	12.80	7.23	9.47			4/26/96	51.64	0.72	37.76	0.53	1.25	0.48	0.04	LE	FF
MEAN=	11.68	11.06	7.05	9.73			MEAN=		4.43		6.16	10.59		1.009		
MEDIAN	9.00	11.90	7.02	9.75			MEDIAN		1.89		4.31	9.74		0.441		
STDDEV	7.11	3.99	0.12	0.55			STDDEV		6.02		5.95	9.96		1.555		
N	13	7	11	10			N		13		13	13		13		
WELL: RC-2							WELL: RC-2									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	9.30	11.00	7.31		2.40		1/16/95	5.47	0.08	236.61	3.31	3.39	31.62	2.50	H	S
2/9/95							2/9/95								L	NO B/N
3/23/95				11.00			3/23/95								L	NO B/N
4/20/95	4.00		6.99				4/20/95	8.61	0.12	582.19	8.15	8.27	32.76	2.59	L	NO B
5/18/95	6.00		7.13	13.50	80.00	16.88	5/18/95	2.12	0.03	377.00	5.28	5.31	65.03	5.14	L	FF
5/24/95	8.00		7.45	9.12	440.00	5.45	5/24/95	0.62	0.01	216.89	3.04	3.05	65.85	5.20	H	FF
6/14/95	8.00	10.50	7.04	10.85	29.60	14.19	6/14/95	4.37	0.06	0.46	0.01	0.07	28.50	2.25	LF	FF
7/10/95	10.00	15.50	7.12	9.35	739.00	1.04	7/10/95	26.01	0.36	1017.72	14.25	14.61	0.64	0.05	HE	FF
8/23/95	25.00		7.02	10.27	99.67	8.70	8/23/95	8.15	0.11	644.78	9.03	9.14	0.22	0.02	H	FF
11/16/95	6.00			8.10			11/16/95	0.57	0.01	385.03	5.39	5.40	0.24	0.02	HF	FF
12/5/95	5.00		7.42	8.50			12/5/95	5.10	0.07	179.88	2.52	2.59	1.40	0.11	HF	FF
3/12/96	5.00	9.50	7.35				3/12/96	0.47	0.01	60.34	0.84	0.85	0.17	0.01	LE	FF
4/26/96	2.00	12.20	7.40	13.24			4/26/96	4.40	0.06	25.64	0.36	0.42	0.08	0.01	LE	FF
MEAN=	8.03	11.74	7.22	10.44			MEAN=		0.08		4.74	4.83		1.626		
MEDIAN	6.00	11.00	7.22	10.27			MEDIAN		0.06		3.31	3.39		0.111		
STDDEV	6.10	2.32	0.18	1.93			STDDEV		0.10		4.33	4.41		2.058		
N	11	5	10	9			N		11		11	11		11		

WELL: RC-3							WELL: RC-3									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	4.70	10.50			8.40		1/16/95	1003.48	14.05	1161.34	16.26	30.31	11.97	0.95	H	S, Me tntc
2/9/95	7.00	8.50			24.00		2/9/95	73.47	1.03	1104.66	15.47	16.49	3.95	0.31	L	S, Me tntc
3/23/95	16.50		7.00	6.35	11.40	21.05	3/23/95	722.19	10.11	1145.98	16.04	26.15	13.44	1.06	L	FF
4/20/95	5.00		7.09				4/20/95	79.57	1.11	10.39	0.15	1.26	8.95	0.71	L	FF
5/18/95	2.00		7.19	7.90	11.00	23.64	5/18/95	125.12	1.75	320.16	4.48	6.23	53.34	4.21	L	FF
5/24/95	8.00		7.11	7.85	7.40	21.62	5/24/95	204.98	2.87	107.61	1.51	4.38	12.02	0.95	H	FF
6/14/95	4.00	13.20	6.79	8.17	17.20	11.63	6/14/95	1835.25	25.69	0.78	0.01	25.70	15.47	1.22	LF	FF
7/10/95	16.00	16.00	6.66	8.50	4.57	31.25	7/10/95	1296.64	18.15	126.35	1.77	19.92	5.85	0.46	HE	FF
8/23/95	28.00	18.70	6.71	7.80	7.80	20.51	8/23/95	27.19	0.38	10.36	0.15	0.53	5.56	0.44	H	FF
11/16/95	19.00			7.78			11/16/95	81.52	1.14	28.60	0.40	1.54	4.52	0.36	HF	FF
12/5/95	11.00		6.90	8.53			12/5/95	528.33	7.40	16.39	0.23	7.63	0.24	0.02	HF	FF
3/12/96	16.00		6.21	8.65			3/12/96	52.44	0.73	44.78	0.63	1.36	2.48	0.20	LE	FF
4/26/96				8.35			4/26/96								LE	NO B/N
MEAN=	11.43	13.38	6.85	7.99			MEAN=		7.04		4.76	11.79		0.907		
MEDIAN	9.50	13.20	6.90	8.04			MEDIAN		2.31		1.07	6.93		0.584		
STDDEV	7.76	4.10	0.30	0.66			STDDEV		8.34		6.85	11.22		1.106		
N	12	5	9	10			N		12		12	12		12		
WELL: RC-4							WELL: RC-4									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/16/95	15.10	8.90			10.30		1/16/95	21.15	0.30	1303.97	18.26	18.55	39.71	3.14	H	S
2/9/95	14.00	11.80			12.70		2/9/95	59.20	0.83	1097.87	15.37	16.20	0.42	0.03	L	S
3/23/95	5.00		7.08	6.00	23.00	26.96	3/23/95	38.41	0.54	612.86	8.58	9.12	84.46	6.67	L	FF
4/20/95	8.00		7.09				4/20/95	128.06	1.79	1123.64	15.73	17.52	3.30	0.26	L	FF
5/18/95	8.00		7.14	6.95	146.00	21.92	5/18/95	1237.08	17.32	447.13	6.26	23.58	50.66	4.00	L	FF
5/24/95	8.00		7.25	4.30	3.80	31.58	5/24/95	169.19	2.37	465.77	6.52	8.89	87.45	6.91	H	FF
6/14/95	10.00	13.00	7.48	7.15	7.60	23.68	6/14/95	262.05	3.67	2.29	0.03	3.70	33.70	2.66	LF	FF
7/10/95	10.00	20.00	7.42	7.50	16.60	21.69	7/10/95	28.32	0.40	986.53	13.81	14.21	2.37	0.19	HE	FF
8/23/95	10.00	23.00	7.27	7.52.	48.00	16.67	8/23/95	2.48	0.03	315.63	4.42	4.45	0.29	0.02	H	NO B
11/16/95	14.00			6.93			11/16/95	1039.51	14.55	265.75	3.72	18.27	0.18	0.01	HF	NO B
12/5/95	18.00		6.41	7.35			12/5/95	172.15	2.41	385.16	5.39	7.80	0.50	0.04	HF	FF
3/12/96	18.00		5.77	7.55			3/12/96	0.00	0.00	85.03	1.19	1.19	4.28	0.34	L	FF
4/26/96	17.00		6.31	7.12			4/26/96	16.48	0.23	1052.11	14.73	14.96	1.96	0.15	LE	NO B/N
MEAN=	11.62	15.34	6.92	6.78			MEAN=		3.42		8.77	12.19		1.879		
MEDIAN	10.00	13.00	7.12	7.12			MEDIAN		0.83		6.52	14.21		0.261		
STDDEV	4.67	5.91	0.56	1.03			STDDEV		5.70		6.08	6.81		2.574		
N	13	5	10	9			N		13		13	13		13		

TABLE 8F: Site RC-Microbiological Database

WELL: RC-1 DEEP

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	17		0	30	H	S
2/9/95	57	50	6	50	L	S
3/23/95	7.5	7	2.75	0.49	L	FF
4/20/95	1	0.49	6.25	0.24	L	FF
5/18/95	7	7	0.25	0.24	L	FF
5/24/95	3.5	1	1.5	0.24	H	FF
6/14/95	7.75	3.75	8.5	0.24	LF	FF
7/10/95	0.24	0.24	9.25	0.24	HE	FF
8/23/95	32.5	25.5	0.24	0.24	H	FF
11/16/95	17.75	0.24	5.25	0.24	HF	FF
12/5/95	0.24	0.24	0.24	0.24	HF	FF
3/12/96	0.24	0.24	0.24	0.24	L	FF
4/25/96	0.24	0.24	0.24	0.24	LE	FF
GEOMEAN=	**2.05**	**1.06**	**1.22**	**0.26**		
STDEV	**9.99**	**7.56**	**3.54**	**0.08**		
COUNT	**11**	**11**	**11**	**11**		

WELL: RC-2

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	0	0	0	0	H	S
2/9/95					L	NO B/N
3/23/95					L	NO B/N
4/20/95					L	NO B
5/18/95	0.24	0.24	0.24	0.24	L	FF
5/24/95	0.24	0.24	0.24	0.24	H	FF
6/14/95	0.24	0.24	0.25	0.24	LF	FF
7/10/95	0.24	0.24	27.25	0.24	HE	FF
8/23/95	0.24	0.24	0.24	0.24	H	FF
11/16/95	0.24	0.24		0.24	HF	FF
12/5/95	0.24	0.24	0.24	0.24	HF	FF
3/12/96	0.24	0.24	0.24	0.24	L	FF
4/25/96	0.24	0.24	0.24	0.24	LE	FF
GEOMEAN=	**0.24**	**0.24**	**0.44**	**0.24**		
STDEV	**0.00**	**0.00**	**9.55**	**0.00**		
COUNT	**9**	**9**	**8**	**9**		

WELL: RC-3

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	1144		4100	388	H	S, Me tntc
2/9/95	288	175	2100	333	L	S, Me tntc
3/23/95	10	10	4.9	2.4	L	FF
4/20/95	4.75	3	1	0.24	L	FF
5/18/95	1	1	1.25	0.24	L	FF
5/24/95	0.25	0.25	0.75	0.24	H	FF
6/14/95	0.24	0.24	3.5	0.24	LF	FF
7/10/95	0.24	0.24	54.25	0.25	HE	FF
8/23/95	0.24	0.24	0.25	0.24	H	FF
11/16/95	0.25	0.24	0.24	4	HF	FF
12/5/95	0.24	0.24	0.25	0.24	HF	FF
3/12/96					L	NO B/N
4/25/96					LE	NO B/N
GEOMEAN=	**0.60**	**0.57**	**1.33**	**0.43**		
STDEV	**3.37**	**3.24**	**17.65**	**1.36**		
COUNT	**9**	**9**	**9**	**9**		

WELL: RC-4

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/16/95	0	0	3	0	H	S
2/9/95	0	0	0	0	L	S
3/23/95	1	1	0.25	0.24	L	FF
4/20/95	0.24	0.24	0.24	0.24	L	FF
5/18/95	0.24	0.24	3.5	0.24	L	FF
5/24/95	0.24	0.24	0.24	0.24	H	FF
6/14/95	0.24	0.24	0.24	0.24	LF	FF
7/10/95	0.24	0.24	0.24	0.24	HE	FF
8/23/95					H	NO B
11/16/95	0.09	0.09			HF	FF
12/5/95	0.09	0.09			HF	FF
3/12/96	0.09	0.09			L	FF
4/25/96					LE	NO B/N
GEOMEAN=	**0.20**	**0.20**	**0.38**	**0.24**		
STDEV	**0.28**	**0.28**	**1.33**	**0.00**		
COUNT	**9**	**9**	**6**	**6**		

TABLE 8G: Site CSL-Nutrient Database																
WELL: CSL-1							WELL: CSL-1	um	mg/L	um	mg/L	mg/L	um	mg/L		
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.30	6.00	6.83		85.70		1/3/95	162.00	2.27	4.80	0.07	2.34	0.07	0.01	H	M
2/16/95	0.30	7.00	7.81	7.67	0.40		2/16/95	87.78	1.23	1.46	0.02	1.25	0.01	0.00	L	S
2/23/95	0.20	6.00		7.35			2/23/95	75.16	1.05	22.50	0.32	1.37	0.02	0.00	L	PF
3/30/95	0.00		6.93	7.00	4.00	25.00	3/30/95	66.86	0.94	2.15	0.03	0.97	0.93	0.07	H	PF
4/25/95	0.00		7.00		17.20	12.36	4/25/95	71.99	1.01	3.67	0.05	1.06	0.05	0.00	H	PF
5/11/95	0.00		7.08	3.94	682.33	2.20	5/11/95	78.95	1.11	1.59	0.02	1.13	0.18	0.01	E	NO B
6/5/95	0.00		7.19	3.97	22.00	18.18	6/5/95	58.831	0.82	6.613	0.09	0.92	0.16	0.01	E	NO B
6/26/95							6/26/95								HF	NO B/N
7/12/95				4.77			7/12/95								H	NO B/N
8/16/95				5.05			8/16/95								HF	NO B/N
10/26/95	0.00		6.79	3.94	568.40	3.09	10/26/95	95.89	1.34	0.92	0.01	1.36	0.349	0.03	HF	PF
2/22/96	0.00		7.14	1.93			2/22/96	427.16	5.98	7.79	0.11	6.09	0.137	0.01	LE	PF
4/11/96	0.00	7.00	7.13	2.30			4/11/96	269.93	3.78	20.8	0.29	4.07	0.017	0.00	HE	PF
5/7/96	0.00	14.00	7.03	2.85			5/7/96	89.18	1.25	13.47	0.19	1.44	0.006	0.00	L	PF
6/3/96	0.00	16.50	7.04	3.60			6/3/96	105.07	1.47	5.46	0.08	1.55	0.225	0.02	HF	PF
MEAN=	0.07	9.42	7.09	4.53			MEAN=		1.85		0.11	1.96		0.01		
MEDIAN	0.00	7.00	7.04	3.96			MEDIAN		1.24		0.07	1.36		0.01		
STDDEV	0.12	4.61	0.27	1.92			STDDEV		1.53		0.10	1.56		0.02		
N	12	6	11	12			N		12		12	12		12		
WELL: CSL-2							WELL: CSL-2									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.30	5.00	6.65		179.80		1/3/95	922.08	12.91	3.42	0.05	12.96	0.02	0.00	H	M
2/16/95	0.30	5.10	6.60	4.04	1.10		2/16/95	98.67	1.38	2.67	0.04	1.42	0.01	0.00	L	S
2/23/95	0.20	5.20		3.80	·		2/23/95	145.98	2.04	1.67	0.02	2.07	0.02	0.00	L	PF
3/30/95	0.00		6.74	0.83	1316.00	1.90	3/30/95	86.48	1.21	1.75	0.02	1.24	0.10	0.01	H	PF
4/25/95	0.00		6.78		1.20	33.33	4/25/95	56.43	0.79	2.03	0.03	0.82	0.05	0.00	H	PF
5/11/95	0.00		6.66	4.34	626.00	8.31	5/11/95	47.98	0.67	5.12	0.07	0.74	0.00	0.00	E	PF
6/5/95	0.00		7.03	4.35	353.80	1.30	6/5/95	43.33	0.61	0.23	0.00	0.61	0.06	0.00	E	PF
6/26/95	0.00		7.16		4.00	25.00	6/26/95	38.39	0.54	2.11	0.03	0.57	0.10	0.01	HF	PF
7/12/95				5.18			7/12/95								H	NO B/N
8/16/95				5.45			8/16/95								HF	NO B/N
10/26/95	0.00		6.86	4.34	98.66	3.70	10/26/95	165.24	2.31	1.61	0.02	2.34	0.24	0.02	HF	PF
2/22/96	0.00		7.13	2.35			2/22/96	120.94	1.69	3.78	0.05	1.75	0.46	0.04	LE	PF
4/11/96	0.00	7.00	6.93	2.76			4/11/96	110.47	1.55	3.54	0.05	1.60	0.01	0.00	HE	PF
5/7/96	0.00	12.10	7.03	3.38			5/7/96	77.97	1.09	3.17	0.04	1.14	0.07	0.01	L	PF
6/3/96	0.00	15.00	7.12	3.92			6/3/96	59.51	0.83	2.46	0.03	0.87	0.04	0.00	HF	PF
MEAN=	0.06	8.23	6.89	3.73			MEAN=		2.13		0.04	2.16		0.01		
MEDIAN	0.00	6.10	6.90	3.98			MEDIAN		1.21		0.03	1.24		0.00		
STDDEV	0.12	4.28	0.20	1.27			STDDEV		3.29		0.02	3.29		0.01		
N	13	6	12	12			N		13		13	13		13		

WELL: CSL-3							WELL: CSL-3									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.30	5.50	6.75		754.00		1/3/95	357.53	5.01	39.36	0.55	5.56	0.02	0.00	H	M
2/16/95							2/16/95								L	didn't samp
2/23/95	0.20	5.80		6.60			2/23/95	62.29	0.87	31.91	0.45	1.32	0.02	0.00	L	PF
3/30/95	0.00		6.63	6.67	13.80	14.49	3/30/95	156.34	2.19	11.31	0.16	2.35	0.04	0.00	H	PF
4/25/95	0.00		6.71		2.40	25.00	4/25/95	148.42	2.08	41.41	0.58	2.66	0.06	0.00	H	PF
5/11/95	0.00		6.72	3.16	715.50	2.17	5/11/95	144.04	2.02	44.27	0.62	2.64	0.03	0.00	E	PF
6/5/95	0.00		6.77	3.14	594.40	1.72	6/5/95	126.74	1.77	45.53	0.64	2.41	0.08	0.01	E	PF
6/26/95	0.00		6.85		1216.00	1.15	6/26/95	134.15	1.88	49.45	0.69	2.57	0.16	0.01	HF	PF
7/12/95	0.00	19.30	7.11	4.11	390.20	3.74	7/12/95	148.08	2.07	63.20	0.88	2.96	0.22	0.02	H	PF
8/16/95	0.00	21.30	6.89	4.22	85.40	1.64	8/16/95	145.21	2.03	66.32	0.93	2.96	0.02	0.00	HF	PF
10/26/95	0.00		6.66	2.87	3.00	26.66	10/26/95	235.00	3.29	75.54	1.06	4.35	0.17	0.01	HF	PF
2/22/96	0.00		6.94	0.88			2/22/96	469.80	6.58	44.12	0.62	7.19	0.13	0.01	F	PF
4/11/96	0.00	6.60	6.87	1.62			4/11/96	566.03	7.92	47.77	0.67	8.59	0.05	0.00	LE	PF
5/7/96	0.00	12.80	6.90	2.33			5/7/96	389.03	5.45	38.60	0.54	5.99	0.08	0.01	LF	PF
6/3/96	0.00	13.50	6.98	2.97			6/3/96	210.48	2.95	28.82	0.40	3.35	0.02	0.00	HF	PF
MEAN=	0.04	12.11	6.83	3.51			MEAN=		3.29		0.63	3.92		0.01		
MEDIAN	0.00	12.80	6.85	3.14			MEDIAN		2.13		0.62	2.96		0.00		
STDDEV	0.09	6.49	0.14	1.62			STDDEV		2.10		0.23	2.12		0.01		
N	14	7	13	11			N		14		14	14		14		
WELL: CSL-4							WELL: CSL-4									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.30	8.00	6.74		118.30		1/3/95	988.15	13.83	18.33	0.26	14.09	0.60	0.05	H	M
2/16/95							2/16/95								L	didn't samp
2/23/95	0.20	8.00		7.00			2/23/95	110.40	1.55	24.59	0.34	1.89	0.19	0.01	L	PF
3/30/95	0.00		6.76	7.03	8.20	21.95	3/30/95	139.35	1.95	113.46	1.59	3.54	3.58	0.28	H	PF
4/25/95	0.00		6.93		818.00	7.33	4/25/95	23.48	0.33	1261.75	17.66	17.99	0.37	0.03	H	PF
5/11/95	0.00		6.95	3.53	600.00	6.33	5/11/95	189.39	2.65	1270.28	17.78	20.44	0.09	0.01	E	PF
6/5/95	0.00		7.17	3.63	235.33	7.65	6/5/95	106.71	1.49	1259.25	17.63	19.12	1.85	0.15	E	PF
6/26/95	0.00		6.97		531.40	1.24	6/26/95	27.46	0.38	904.65	12.67	13.05	1.00	0.08	HF	PF
7/12/95		24.50		4.52			7/12/95								H	NO B/N
8/16/95				4.84			8/16/95								HF	NO B/N
10/26/95	0.00		6.78	3.48	119.20	1.00	10/26/95	1279.55	17.91	109.32	1.53	19.44	0.14	0.01	HF	PF
2/22/96	0.00		6.86	1.65			2/22/96	120.94	1.69	3.78	0.05	1.75	3.00	0.24	LE	PF
4/11/96	0.00	7.00	6.93	2.12			4/11/96	504.69	7.07	132.49	1.85	8.92	0.24	0.02	HE	PF
5/7/96	0.00	12.50	6.72	2.68			5/7/96	151.84	2.13	139.84	1.96	4.08	1.26	0.10	L	PF
6/3/96	0.00	15.00	6.99	3.32			6/3/96	127.19	1.78	81.75	1.14	2.93	0.13	0.01	HF	PF
MEAN=	0.04	11.83	6.89	3.86			MEAN=		4.40		6.21	10.60		0.08		
MEDIAN	0.00	9.75	6.93	3.53			MEDIAN		1.87		1.72	10.99		0.04		
STDDEV	0.10	7.24	0.14	1.75			STDDEV		5.69		7.69	7.56		0.09		
N	12	6	11	11			N		12		12	12		12		

ELL: CSL-5 DEEP?							WELL: CSL-5 DEEP?									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.30	6.80	6.86		426.40		1/3/95	142.99	2.00	5.43	0.08	2.08	0.18	0.01	H	M
2/16/95	0.30	10.00		6.77	73.80		2/16/95	1209.94	16.94	7.69	0.11	17.05	0.07	0.01	L	S
2/23/95	0.20	7.80		6.60			2/23/95	93.70	1.31	10.01	0.14	1.45	0.43	0.03	L	PF
3/30/95	0.00		7.26	6.60	2130.00	1.60	3/30/95	86.29	1.21	2.15	0.03	1.24	0.11	0.01	H	PF
4/25/95	0.00		7.37		866.00	3.12	4/25/95	78.66	1.10	2.77	0.04	1.14	0.15	0.01	H	PF
5/11/95	0.00		7.35	2.92	839.00	1.91	5/11/95	79.32	1.11	3.91	0.05	1.17	0.04	0.00	E	PF
6/5/95	0.00		7.29	2.77	1131.00	0.16	6/5/95	78.90	1.10	1.88	0.03	1.13	0.12	0.01	E	PF
6/26/95	0.00		7.30		4424.00	0.41	6/26/95	45.70	0.64	2.12	0.03	0.67	0.12	0.01	HF	PF
7/12/95	0.00	16.00	7.38	3.82	1232.00	0.60	7/12/95	76.56	1.07	1.96	0.03	1.10	0.06	0.00	H	PF
8/16/95	*0.00*	*16.50*	*7.16*	*4.04*	*1039.20*	*0.77*	*8/16/95*	*57.04*	*0.80*	*3.73*	*0.05*	*0.85*	*0.00*	*0.00*	HF	PF
10/26/95	0.00		7.06	2.96	516.00	4.26	10/26/95	21.66	0.30	2.43	0.03	0.34	0.20	0.02	HF	PF
2/22/96	0.00		7.26				2/22/96	9.23	0.13	28.53	0.40	0.53	0.42	0.03	LE	PF
4/11/96	0.00	8.60	7.21	1.46			4/11/96	77.58	1.09	4.84	0.07	1.15	0.03	0.00	HE	PF
5/7/96	0.00	11.00	7.25	2.27			5/7/96	49.05	0.69	5.93	0.08	0.77	0.18	0.01	L	PF
6/3/96	0.00	12.40	7.36	2.62			6/3/96	75.76	1.05	2.26	0.03	1.09	0.01	0.00	HF	PF
MEAN=	**0.05**	**11.39**	**7.24**	**3.89**			**MEAN=**		**2.04**		**0.08**	**2.12**		**0.01**		
MEDIAN	**0.00**	**10.50**	**7.26**	**2.96**			**MEDIAN**		**1.09**		**0.05**	**1.13**		**0.01**		
STDDEV	**0.11**	**4.08**	**0.15**	**1.90**			**STDDEV**		**4.15**		**0.09**	**4.15**		**0.01**		
N	**15**	**8**	**13**	**11**			**N**		**15**		**15**	**15**		**15**		

WELL: CSL-6							WELL: CSL-6									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.20	6.00	6.79		83.50		1/3/95	254.30	3.56	158.77	2.22	5.78	0.19	0.02	H	M
2/16/95							2/16/95								L	didn't samp
2/23/95	0.20	6.00		6.10			2/23/95	92.84	1.30	8.43	0.12	1.42	0.12	0.01	L	PF
3/30/95	0.00		6.91	6.30	30.00	6.67	3/30/95	65.01	0.91	2.45	0.03	0.94	0.10	0.01	H	PF
4/25/95	0.00		6.78		606.00	4.95	4/25/95	73.51	1.03	6.82	0.10	1.12	0.05	0.00	H	PF
5/11/95	0.00		6.97	2.72	654.00	3.36	5/11/95	79.56	1.11	6.23	0.09	1.20	0.02	0.00	E	PF
6/5/95	0.00		6.98	2.82	395.25	2.72	6/5/95	70.79	0.99	9.16	0.13	1.12	0.10	0.01	E	PF
6/26/95	0.00		7.00		134.00	3.73	6/26/95	71.85	1.01	7.49	0.10	1.11	0.21	0.02	HF	PF
7/12/95	0.00	15.00	7.10	3.67	3317.67	1.42	7/12/95	75.74	1.06	6.97	0.10	1.16	0.23	0.02	H	PF
8/16/95	0.00	18.00	7.07	3.97	1177.33	0.48	8/16/95	66.75	0.93	3.48	0.05	0.98	0.00	0.00	HF	PF
10/26/95	0.00			2.31			10/26/95								HF	PF, no N
2/22/96	0.00		7.13	0.69			2/22/96	5.54	0.08	180.05	2.52	2.60	0.09	0.01	LE	PF
4/11/96	0.00	7.50	6.95	1.20			4/11/96	196.66	2.75	24.43	0.34	3.10	0.05	0.00	HE	PF
5/7/96	0.00	10.40	6.81	2.02			5/7/96	81.71	1.14	4.73	0.07	1.21	0.09	0.01	L	PF
6/3/96	0.00	11.00	7.04	2.74			6/3/96	137.24	1.92	4.23	0.06	1.98	0.01	0.00	HF	PF
MEAN=	**0.03**	**10.56**	**6.96**	**3.14**			**MEAN=**		**1.37**		**0.46**	**1.63**		**0.01**		
MEDIAN	**0.00**	**10.40**	**6.98**	**2.74**			**MEDIAN**		**1.06**		**0.10**	**1.20**		**0.01**		
STDDEV	**0.07**	**4.59**	**0.12**	**1.79**			**STDDEV**		**0.90**		**0.86**	**1.36**		**0.01**		
N	**14**	**7**	**12**	**11**			**N**		**13**		**13**	**13**		**13**		

WELL: CSL-LYSIMETER							WELL: CSL-LYSIMETER									
DATE	SALINITY	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
8/16/95	0		7.25		0.8	33.33	8/16/95	1956.75	27.39	4.19	0.06	27.45	50.73	4.01		
11/14/95							11/14/95									EMPTY
11/16/95	0						11/16/95	1432.67	20.06	2.52	0.04	20.09	48.07	3.80		
1/30/96							1/30/96									15mls
2/8/96	0		6.93				2/8/96	806.76	11.29	1.15	0.02	11.31	67.32	5.32		
2/22/96	0		6.87				2/22/96	3.89	0.05	680.73	9.53	9.58	60.83	4.80		
2/29/96	0		6.9				2/29/96	93.39	1.31	6.62	0.09	1.40	72.92	5.76		
3/12/96							3/12/96									400mls
3/13/96	0		6.91				3/13/96	106.59	1.49	2.10	0.03	1.52	45.92	3.63		
4/11/96	0		7.05				4/11/96	115.99	1.62	8.07	0.11	1.74	47.82	3.78		
5/7/96	0		7.05				5/7/96	94.68	1.33	3.46	0.05	1.37	49.25	3.89		200mls
5/9/96	0		6.74				5/9/96	29.37	0.41	2.86	0.04	0.45	42.31	3.34		200mls
6/3/96							6/3/96	15.58	0.22	148.19	2.07	2.29	44.81	3.54		200mls
6/5/96	0		6.86				6/5/96	28.41	0.40	1772.46	24.81	25.21	108.18	8.54		
MEAN=	**0.00**		**6.95**				**MEAN=**		**5.96**		**3.35**	**9.31**		**4.582**		
MEDIAN	**0.00**		**6.91**				**MEDIAN**		**1.33**		**0.06**	**2.29**		**3.890**		
STDDEV	**0.00**		**0.15**				**STDDEV**		**9.48**		**7.66**	**10.36**		**1.526**		
N	**10**		**9**				**N**		**11**		**11**	**11**		**11**		

TABLE 8G: Site CSL-Microbiological Database

WELL: CSL-1

DATE	FC	EC	Enterococci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*15*	*H*	*M*
2/16/95	*0*	*0*	*0*	*0*	*L*	*S*
2/23/95	0.24	0.24	1	0.24	L	FF
3/30/95	0.24	0.24	0.24	0.24	H	FF
4/25/95	0.24	0.24	0.24	1.25	H	FF
5/11/95					E	NO B
6/5/95					E	NO B
6/26/95					HF	NO B/N
7/12/95					H	NO B/N
8/16/95					HF	NO B/N
10/26/95	0.09	0.09	22.75	0.09	HF	FF
2/22/96	0.24	0.24	0.24	0.24	F	FF
4/11/96	0.24	0.24	2	0.75	HE	FF
5/7/96	0.24	0.24	0.24	0.24	L	FF
6/3/96	0.49	0.49	0.49	0.5	HF	FF
GEOMEAN=	**0.23**	**0.23**	**0.72**	**0.33**		
STDEV	**0.11**	**0.11**	**7.84**	**0.39**		
COUNT	**8.00**	**8.00**	**8.00**	**8.00**		

WELL: CSL-2

DATE	FC	EC	Enterococci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*0*	*H*	*M*
2/16/95	*0*	*0*	*76*	*12*	*L*	*S*
2/23/95	0.24	0.24	0.49	0.24	L	FF
3/30/95	0.24	0.24	0.24	0.24	H	FF
4/25/95	0.24	0.24	0.24	0.24	H	FF
5/11/95	0.24	0.24	0.24	0.24	E	FF
6/5/95	0.24	0.24	0.24	0.24	E	FF
6/26/95	6.5	6.25	0.24	0.24	HF	FF
7/12/95					H	NO B/N
8/16/95					HF	NO B/N
10/26/95	0.24	0.24	7.5	0.24	HF	FF
2/22/96	0.24	0.24	1	1.25	F	FF
4/11/96	0.24	0.24	0.24	0.24	HE	FF
5/7/96	0.24	0.24	0.24	0.24	L	FF
6/3/96	0.24	0.24	0.24	0.24	HF	FF
GEOMEAN=	**0.32**	**0.32**	**0.40**	**0.28**		
STDEV	**1.89**	**1.81**	**2.17**	**0.30**		
COUNT	**11.00**	**11.00**	**11.00**	**11.00**		

WELL: CSL-3

DATE	FC	EC	Enterococci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*30*	*H*	*M*
2/16/95					L	didn't samp
2/23/95	0.24	0.24	0.49	0.24	L	FF
3/30/95	0.24	0.24	0.24	0.24	H	FF
4/25/95	0.24	0.24	0.24	0.25	H	FF
5/11/95	0.24	0.24	0.24	0.24	E	FF
6/5/95	0.24	0.24	0.24	0.24	E	FF
6/26/95	5.75	5.75	0.24	0.24	HF	FF
7/12/95	0.24	0.24	0.24	0.24	H	FF
8/16/95	2	2	2.75	0.24	HF	FF
10/26/95	0.24	0.24	0.24	0.24	HF	FF
2/22/96	2.75	2.75	6.75	0.24	F	FF
4/11/96	0.24	0.24	0.24	0.24	HE	FF
5/7/96	0.24	0.24	0.24	0.24	L	FF
6/3/96	0.24	0.24	0.24	0.24	HF	FF
GEOMEAN=	**0.44**	**0.44**	**0.40**	**0.24**		
STDEV	**1.64**	**1.64**	**1.87**	**0.00**		
COUNT	**13.00**	**13.00**	**13.00**	**13.00**		

WELL: CSL-4

DATE	FC	EC	Enterococci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*490*	*H*	*M*
2/16/95					L	didn't samp
2/23/95	1	1	0.49	0.24	L	FF
3/30/95	0.24	0.24	0.5	0.5	H	FF
4/25/95	0.24	0.24	0.24	22	H	FF
5/11/95	0.25	0.25	0.24	0.24	E	FF
6/5/95	0.24	0.24	0.24	2	E	FF
6/26/95	53.25	48.5	0.24	2.25	HF	FF
7/12/95					H	NO B/N
8/16/95					HF	NO B/N
10/26/95	0.24	0.24	0.24	0.24	HF	FF
2/22/96	10	6	49.5	7.75	F	FF
4/11/96	0.25	0.25	0.24	0.25	HE	FF
5/7/96	0.25	0.25	0.5	0.24	L	FF
6/3/96	0.24	0.24	0.25	0.5	HF	FF
GEOMEAN=	**0.63**	**0.60**	**0.48**	**0.85**		
STDEV	**15.93**	**14.46**	**14.83**	**6.59**		
COUNT	**11.00**	**11.00**	**11.00**	**11.00**		

ELL: CSL-5 DEEP?

DATE	FC	EC	Enterococci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*0*	*H*	*M*
2/16/95	*0*	*0*	*0*	*0*	*L*	*S*
2/23/95	0.24	0.24	0.49	0.24	L	FF
3/30/95	0.24	0.24	0.24	0.24	H	FF
4/25/95	0.24	0.24	0.24	0.24	H	FF
5/11/95	0.24	0.24	0.24	0.24	E	FF
6/5/95	0.24	0.24	0.25	0.24	E	FF
6/26/95	1.25	1.25	0.24	0.24	HF	FF
7/12/95	0.24	0.24	4	0.24	H	FF
8/16/95	4.75	4.75	0.24	0.25	HF	FF
10/26/95	0.24	0.24	0.24	0.24	HF	FF
2/22/96	0.25	0.24	6.75	3.5	F	FF
4/11/96	0.24	0.24	0.24	0.5	HE	FF
5/7/96	0.24	0.24	0.24	0.24	L	FF
6/3/96	0.24	0.24	0.24	0.24	HF	FF
GEOMEAN=	**0.34**	**0.34**	**0.41**	**0.31**		
STDEV	**1.26**	**1.26**	**2.00**	**0.90**		
COUNT	**13.00**	**13.00**	**13.00**	**13.00**		

WELL: CSL-6

DATE	FC	EC	Enterococci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*170*	*H*	*M*
2/16/95					L	didn't samp
2/23/95	2	2	0.49	0.24	L	FF
3/30/95	0.24	0.24	0.24	0.24	H	FF
4/25/95	0.24	0.24	0.24	0.24	H	FF
5/11/95	0.24	0.24	0.24	0.24	E	FF
6/5/95	0.24	0.24	0.24	0.24	E	FF
6/26/95	2.25	2	0.24	0.24	HF	FF
7/12/95	0.5	0.5	0.24	0.24	H	FF
8/16/95	0.24	0.24	0.24	0.24	HF	FF
10/26/95	0.24	0.24	0.24	0.24	HF	PF, no N
2/22/96	0.24	0.24	0.24	0.24	F	FF
4/11/96	0.24	0.24	0.24	0.24	HE	FF
5/7/96	0.24	0.24	0.24	0.24	L	FF
6/3/96	0.24	0.24	0.24	0.24	HF	FF
GEOMEAN=	**0.36**	**0.35**	**0.25**	**0.24**		
STDEV	**0.70**	**0.66**	**0.07**	**0.00**		
COUNT	**13**	**13**	**13**	**13**		

TABLE 8H: Site WRH-Nutrient Database

WELL: WRH-1							WELL: WRH-1									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95			7.07		159.10		1/3/95	150.68	2.11	1250.83	17.51	19.62	1.54	0.12	H	M, FC mc
2/16/95				6.91			2/16/95								L	NO B/N
3/2/95				6.60			3/2/95								L	NO B/N
3/30/95				6.99			3/30/95								H	NO B/N
4/6/95				7.17			4/6/95								L	NO B/N
4/25/95							4/25/95								H	NO B/N
5/11/95				7.75			5/11/95								E	NO B/N
6/26/95			6.72		6.22	17.86	6/26/95								HF	NO B/N
7/12/95				8.87			7/12/95								H	NO B/N
8/16/95				8.95			8/16/95								HF	NO B/N
11/18/95	0.00		7.03	6.21			11/18/95	1010.99	14.15	263.43	3.69	17.84	0.25	0.02	HE	FF
2/1/96		3.00		6.02			2/1/96									NO B/N
2/8/96	0.00			7.05			2/8/96	38.44	0.54	129.64	1.81	2.35	0.12	0.01	LE	FF
3/28/96	0.00	8.50	7.41	5.95			3/28/96	22.53	0.32	162.25	2.27	2.59	0.40	0.03	LE	FF
5/9/96	0.00	11.50	7.24	6.56			5/9/96	46.12	0.65	28.89	0.40	1.05	2.30	0.18	LE	FF
MEAN=	0.00	7.67	7.09	7.09			MEAN=		3.55		5.14	8.69		0.073		
MEDIAN	0.00	8.50	7.07	6.95			MEDIAN		0.65		2.27	2.59		0.032		
STDDEV	0.00	4.31	0.26	0.99			STDDEV		5.97		7.02	9.21		0.078		
N	4	3	5	12			N		5		5	5		5		

WELL: WRH-2							WELL: WRH-2									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.50	5.00	6.55		129.90		1/3/95	458.28	6.42	48.87	0.68	7.10	0.14	0.01	H	M
2/16/95							2/16/95								L	didn't samp
3/2/95	0.20	4.00		6.10			3/2/95								L	NO B/N
3/30/95				7.19			3/30/95								H	NO B/N
4/6/95	0.00	4.00	6.78	7.43	394.00	5.84	4/6/95	733.39	10.27	164.21	2.30	12.57	0.05	0.00	L	FF
4/25/95							4/25/95								H	NO B/N
5/11/95				8.07			5/11/95								E	NO B/N
6/26/95	0.00						6/26/95	51.79	0.73	15.42	0.22	0.94	0.76	0.06	HF	NO B
7/12/95				9.02			7/12/95								H	NO B/N
8/16/95				9.10			8/16/95								HF	NO B/N
11/18/95	0.00		6.72	6.25			11/18/95	362.14	5.07	44.80	0.63	5.70	0.06	0.00	HE	FF
2/1/96		4.00		6.52			2/1/96								HE	NO B/N
2/8/96	0.00	6.50	6.57	7.14			2/8/96	5.55	0.08	62.93	0.88	0.96	0.20	0.02	LE	FF
3/28/96	0.00	5.20	6.59	6.63			3/28/96	0.79	0.01	50.99	0.71	0.72	0.08	0.01	LE	FF
5/9/96	0.00	11.50	6.72	7.07			5/9/96	3.16	0.04	50.25	0.70	0.75	0.93	0.07	LE	FF
MEAN=	0.09	5.74	6.66	7.32			MEAN=		3.23		0.87	4.11		0.025		
MEDIAN	0.00	5.00	6.66	7.14			MEDIAN		0.73		0.70	0.96		0.011		
STDDEV	0.18	2.70	0.10	1.02			STDDEV		4.08		0.66	4.58		0.029		
N	8	7	6	11			N		7		7	7		7		

ELL: WRH-3 DEEP							WELL: WRH-3 DEEP									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.90	6.50	6.64		120.60		1/3/95	1370.67	19.19	37.30	0.52	19.71	0.06	0.00	H	M
2/16/95	0.30	10.00	5.91	5.65	19.60		2/16/95	20.21	0.28	126.40	1.77	2.05	0.02	0.00	L	S
3/2/95	0.70	8.00	5.22	5.52	50.70		3/2/95	1263.62	17.69	34.13	0.48	18.17	0.04	0.00	L	FF
3/30/95	0.00		6.66	5.67	298.00	4.70	3/30/95	1284.02	17.98	34.43	0.48	18.46	0.07	0.01	H	FF
4/6/95	0.00	6.90	6.14	5.87	156.00	1.28	4/6/95	1488.31	20.84	74.40	1.04	21.88	0.07	0.01	L	FF
4/25/95	0.00		6.18		115.80	2.94	4/25/95	1246.49	17.45	81.55	1.14	18.59	0.04	0.00	H	FF
5/11/95	0.00		6.94	6.39	55.00	18.79	5/11/95	1325.28	18.55	1129.83	15.82	34.37	4.27	0.34	E	FF
6/26/95	0.00	13.00	6.48		109.00	3.06	6/26/95	1224.44	17.14	43.87	0.61	17.76	0.09	0.01	HF	FF
7/12/95	0.00	15.40	6.33	7.20	491.33	0.81	7/12/95	1327.51	18.59	21.59	0.30	18.89	0.09	0.01	H	FF
8/16/95	0.00	18.00	6.38	7.32	454.33	1.98	8/16/95	1227.64	17.19	33.72	0.47	17.66	0.64	0.05	HF	FF
11/14/95	0.00		6.46	5.49			11/14/95	1128.65	15.80	56.03	0.78	16.59	0.13	0.01	H	FF
11/18/95	0.00		6.34	5.09			11/18/95	1154.01	16.16	27.31	0.38	16.54	0.05	0.00	HE	FF
2/1/96	0.00	4.20	6.61	5.22			2/1/96	1147.42	16.06	29.53	0.41	16.48	0.00	0.00	HE	FF
2/8/96	0.00	6.10	6.76	5.58			2/8/96	1157.19	16.20	19.69	0.28	16.48	0.14	0.01	LE	FF
3/28/96	0.00	7.90	6.74	5.27			3/28/96	1092.52	15.30	32.36	0.45	15.75	0.38	0.03	LE	FF
5/9/96	0.00	10.40	6.98	5.57			5/9/96	1245.89	17.44	32.38	0.45	17.90	0.23	0.02	LE	FF
MEAN=	0.12	9.67	6.42	5.83	187.04	4.79	MEAN=		16.37		1.59	17.95		0.031		
MEDIAN	0.00	8.00	6.47	5.58	118.20	2.94	MEDIAN		17.31		0.48	17.83		0.006		
STDDEV	0.28	4.25	0.43	0.71	168.97	6.30	STDDEV		4.52		3.81	6.09		0.083		
N	16	11	16	13	10	7	N		16		16	16		16		

WELL: WRH-4							WELL: WRH-4									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.90	6.20	6.68		111.50		1/3/95	199.23	2.79	168.75	2.36	5.15	0.22	0.02	H	S
2/16/95							2/16/95								L	didn't samp
3/2/95	0.50	5.00	6.18	5.81	6.70		3/2/95	1.14	0.02	219.30	3.07	3.09	12.05	0.95	L	FF
3/30/95	0.00		6.48	5.98	65.80	15.20	3/30/95	0.78	0.01	224.42	3.14	3.15	21.44	1.69	H	FF
4/6/95	0.00	4.90	6.57	6.20	58.67	9.09	4/6/95	5.38	0.08	1069.12	14.97	15.04	7.07	0.56	L	FF
4/25/95	0.00		6.89		1699.00	2.26	4/25/95	1.96	0.03	1068.35	14.96	14.98	14.46	1.14	H	FF
5/9/95	0.00		6.99		1914.00	4.39	5/9/95	8.37	0.12	1245.79	17.44	17.56	2.60	0.21	H	NO B
5/11/95	0.00		6.28	6.75	64.33	4.66	5/11/95	2.29	0.03	51.32	0.72	0.75	0.16	0.01	E	FF
6/26/95	0.00	15.00	6.99		216.50	8.78	6/26/95	67.20	0.94	1067.16	14.94	15.88	0.15	0.01	HF	FF
7/12/95	0.00	18.30	7.02	8.61	25.50	26.47	7/12/95	760.06	10.64	289.69	4.06	14.70	1.07	0.08	H	FF
8/16/95	0.00	22.30	7.00	8.78	33.20	24.10	8/16/95	61.80	0.87	244.26	3.42	4.28	0.08	0.01	HF	FF
11/14/95	0.00		6.62	5.80			11/14/95	652.70	9.14	194.42	2.72	11.86	0.03	0.00	H	FF
11/18/95	0.00		6.51	5.46			11/18/95	135.51	1.90	331.29	4.64	6.54	0.22	0.02	HE	FF
2/1/96	0.00	2.00	6.62	5.54			2/1/96	332.99	4.66	138.32	1.94	6.60	1.51	0.12	HE	FF
2/8/96	0.00	5.50	6.92	5.92			2/8/96	4.16	0.06	242.23	3.39	3.45	6.94	0.55	LE	FF
3/28/96	0.00	6.00	6.69	5.60			3/28/96	48.91	0.68	385.82	5.40	6.09	0.32	0.02	LE	FF
5/9/96	0.00	10.50	6.70	5.89			5/9/96	36.40	0.51	279.03	3.91	4.42	1.23	0.10	L	FF
MEAN=	0.09	9.57	6.70	6.36	439.52	11.87	MEAN=		2.03		6.32	8.35		0.343		
MEDIAN	0.00	6.10	6.69	5.91	65.07	8.94	MEDIAN		0.60		3.66	6.31		0.091		
STDDEV	0.25	6.74	0.26	1.14	775.37	9.19	STDDEV		3.33		5.66	5.62		0.508		
N	16	10	16	12	10	8	N		16		16	16		16		

WELL: WRH-5							WELL: WRH-5									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95			6.98		160.80		1/3/95	1.15	0.02	1377.67	19.29	19.30	1.17	0.09	H	M, FC tnk
2/16/95							2/16/95								L	didn't samp
3/2/95	0.50	6.00	6.34	7.24	5.50		3/2/95	0.00	0.00	354.34	4.96	4.96	1.25	0.10	L	PF
3/30/95	0.00		6.75	7.26	5.80	44.83	3/30/95	0.03	0.00	349.54	4.89	4.89	1.79	0.14	H	NO B
4/6/95	0.00	5.00	6.89	7.68	133.67	7.48	4/6/95	3.47	0.05	1574.46	22.04	22.09	0.13	0.01	L	PF
4/25/95	0.00		6.93		9.80	34.70	4/25/95	2.09	0.03	1346.23	18.85	18.88	0.47	0.04	H	PF
5/11/95	0.00		6.99	8.22	1232.50	1.14	5/11/95	0.85	0.01	1344.68	18.83	18.84	0.02	0.00	E	NO B
6/26/95		19.20			1188.00	2.19	6/26/95								HF	NO B/N
7/12/95				9.09			7/12/95								H	NO B/N
8/16/95				9.14			8/16/95								HF	NO B/N
11/14/95	0.00		7.36	5.95			11/14/95	1300.07	18.20	328.39	4.60	22.80	0.05	0.00	H	NO B
11/18/95	0.00		6.68	6.42			11/18/95	1271.41	17.80	175.62	2.46	20.26	0.08	0.01	HE	PF
2/1/96		2.50		6.12			2/1/96								HE	NO B/N
2/8/96	0.00			7.27			2/8/96	843.10	11.80	110.45	1.55	13.35	0.31	0.02	LE	PF
3/28/96	0.00	7.50	7.05	6.23			3/28/96	146.69	2.05	110.45	1.55	3.60	0.05	0.00	LE	PF
5/9/96	0.00	12.00	6.78	7.25			5/9/96	15.17	0.21	232.97	3.26	3.47	0.34	0.03	LE	PF
MEAN=	0.05	8.70	6.88	7.32	390.87	18.07	MEAN=		4.56		9.30	13.86		0.041		
MEDIAN	0.00	6.75	6.91	7.26	133.67	7.48	MEDIAN		0.05		4.89	18.84		0.025		
STDDEV	0.16	6.03	0.27	1.08	563.45	20.27	STDDEV		7.50		8.41	8.01		0.048		
N	10	6	10	12	7	5	N		11		11	11		11		

WELL: WRH-6							WELL: WRH-6									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/3/95	0.30	6.00	6.58		223.80		1/3/95	100.79	1.41	3.61	0.05	1.46	0.12	0.01	H	M
2/16/95							2/16/95								L	didn't samp
3/2/95	0.40	5.00	5.94	5.25	22.20		3/2/95	785.89	11.00	2.11	0.03	11.03	0.11	0.01	L	PF
3/30/95	0.00		6.46	5.36	519.00	5.49	3/30/95	738.43	10.34	1.35	0.02	10.36	0.11	0.01	H	PF
4/6/95	0.00	4.90	6.51	5.58	1392.00	4.89	4/6/95	302.66	4.24	7.01	0.10	4.34	0.06	0.00	L	PF
4/25/95	0.00		6.55		1512.00	3.31	4/25/95	229.42	3.21	11.73	0.16	3.38	0.07	0.01	H	PF
5/11/95	0.00		6.99	5.94	863.50	2.03	5/11/95	305.90	4.28	7.30	0.10	4.38	0.02	0.00	E	PF
6/26/95	0.00	14.00	6.51				6/26/95	132.80	1.86	6.22	0.09	1.95	0.08	0.01	HF	PF
7/12/95	0.00	17.20	6.63	7.61	711.00	2.11	7/12/95	112.72	1.58	7.71	0.11	1.69	0.14	0.01	H	PF
8/16/95		21.50	6.46	7.84	3812.33	0.74	8/16/95	203.05	2.84	2.15	0.03	2.87	0.04	0.00	HF	PF
11/18/95	0.00		6.41	5.05			11/18/95	456.95	6.40	3.15	0.04	6.44	0.06	0.00	HE	PF
2/1/96	0.00	4.00	6.85	5.14			2/1/96	419.21	5.87	9.97	0.14	6.01	0.06	0.00	HE	PF
2/8/96	0.00	5.40	6.91	5.35			2/8/96	540.75	7.57	6.45	0.09	7.66	0.12	0.01	LE	PF
3/28/96	0.00	7.20	6.61	5.11			3/28/96	154.09	2.16	9.38	0.13	2.29	0.06	0.00	LE	PF
5/9/96	0.00	10.00	6.53	5.32			5/9/96	177.65	2.49	6.65	0.09	2.58	0.37	0.03	L	PF
MEAN=	0.05	9.52	6.57	5.78	1131.98	3.10	MEAN=		4.66		0.08	4.75		0.008		
MEDIAN	0.00	6.60	6.54	5.35	787.25	2.71	MEDIAN		3.72		0.09	3.86		0.006		
STDDEV	0.13	6.05	0.25	1.00	1199.87	1.83	STDDEV		3.16		0.04	3.14		0.007		
N	13	10	14	11	8	6	N		14		14	14		14		

WELL: WRH-7							WELL: WRH-7									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
3/28/96	0	8	6.84	3.54			3/28/96	88.38	1.24	5.32	0.07448	1.31	0.06	0.00		
5/9/96	0	9.9	6.59	3.49			5/9/96	145.71	2.04	9.48	0.13272	2.17	0.08	0.01		
MEAN=	0.00	8.95	6.72	3.52			MEAN=		1.64		0.10	1.74		0.005		
MEDIAN	0.00	8.95	6.72	3.52			MEDIAN		1.64		0.10	1.74		0.005		
STDDEV	0.00	1.34	0.18	0.04			STDDEV		0.57		0.04	0.61		0.001		
N	2	2	2	2			N		2		2	2		2		

WELL: WRH-8							WELL: WRH-8									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
3/28/96	0	7.2	6.77	3.84			3/28/96	1163.29	16.29	60.51	0.84714	17.13	0.08	0.01		
5/9/96	0	9.9	6.61	4			5/9/96	1279.06	17.91	20.69	0.28966	18.20	0.24	0.02		
MEAN=	0.00	8.55	6.69	3.92			MEAN=		17.10		0.57	17.66		0.012		
MEDIAN	0.00	8.55	6.69	3.92			MEDIAN		17.10		0.57	17.66		0.012		
STDDEV	0.00	1.91	0.11	0.11			STDDEV		1.15		0.39	0.75		0.009		
N	2	2	2	2			N		2		2	2		2		

WELL: WRH-9							WELL: WRH-9									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
3/28/96	0	7	6.62	3.64			3/28/96	892.58	12.50	352	4.928	17.42	0.06	0.01		
5/9/96	0	9	6.6	3.41			5/9/96	981.74	13.74	217.07	3.03898	16.78	0.26	0.02		
MEAN=	0.00	8.00	6.61	3.53			MEAN=		13.12		3.98	17.10		0.013		
MEDIAN	0.00	8.00	6.61	3.53			MEDIAN		13.12		3.98	17.10		0.013		
STDDEV	0.00	1.41	0.01	0.16			STDDEV		0.88		1.34	0.45		0.011		
N	2	2	2	2			N		2		2	2		2		

WELL: WRH-10							WELL: WRH-10									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
3/28/96	0	7.5	6.7	3.11			3/28/96	4.32	0.06	36.06	0.50484	0.57	0.08	0.01		
5/9/96	0	9.8	6.87	2.95			5/9/96	25.85	0.36	25.28	0.35392	0.72	0.13	0.01		
MEAN=	0.00	8.65	6.79	3.03			MEAN=		0.21		0.43	0.64		0.008		
MEDIAN	0.00	8.65	6.79	3.03			MEDIAN		0.21		0.43	0.64		0.008		
STDDEV	0.00	1.63	0.12	0.11			STDDEV		0.21		0.11	0.11		0.003		
N	2	2	2	2			N		2		2	2		2		

L WRH-LYSIMETER						WELL WRH-LYSIMETER						
DATE	SAL	pH	DATE	NO3	**NO3-N**	NH4	**NH4-N**	**DIN**	PO4	**PO4**	TIDE	FILTER
8/16/95	0.00	7.19	8/16/95	1622.11	22.71	10.67	0.15	22.86	2.73	0.22		
9/18/95	0.00	6.41	9/18/95	1653.33	23.15	16.84	0.24	23.38	6.77	0.53		
10/24/95	0.00		10/24/95	1478.41	20.70	0.99	0.01	20.71	4.07	0.32		
11/1/95	0.00		11/1/95	1356.45	18.99	61.26	0.86	19.85	0.96	0.08		
11/14/95	0.00	6.39	11/14/95	1277.27	17.88	14.58	0.20	18.09	0.79	0.06		
11/16/95	0.00		11/16/95	1354.68	18.97	17.47	0.24	19.21	1.22	0.10		
11/18/95	0.00		11/18/95	1374.43	19.24	31.69	0.44	19.69	0.62	0.05		
2/8/96	0.00	6.79	2/8/96	887.00	12.42	454.87	6.37	18.79	0.47	0.04		
2/22/96	0.00	6.78	2/22/96	1056.24	14.79	774.71	10.85	25.63	0.38	0.03		
2/29/96	0.00	6.79	2/29/96	1193.51	16.71	847.62	11.87	28.58	1.30	0.10		
3/13/96	0.00	6.70	3/13/96	1304.16	18.26	300.13	4.20	22.46	0.91	0.07		400mls
4/11/96	0.00	6.72	4/11/96	1192.96	16.70	357.64	5.01	21.71	0.64	0.05		
5/7/96	0.00	6.74	5/7/96	1000.90	14.01	321.37	4.50	18.51	0.17	0.01		
5/9/96	0.00	6.74	5/9/96	191.33	2.68	194.54	2.72	5.40	0.54	0.04		
6/5/96	0.00	6.64	6/5/96	1647.09	23.06	22.26	0.31	23.37	0.48	0.04		
MEAN=	**0.00**	**6.72**	**MEAN=**		**17.35**		**3.20**	**20.55**		**0.116**		
MEDIAN	**0.00**	**6.74**	**MEDIAN**		**18.26**		**0.86**	**20.71**		**0.062**		
STDDEV	**0.00**	**0.21**	**STDDEV**		**5.17**		**3.94**	**5.09**		**0.141**		
N	**15**	**11**	**N**		**15**		**15**	**15**		**15**		

TABLE 8H: Site WRH-Microbiological Database

WELL: WRH-1						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/3/95	*21000*		*35*	*75*	*H*	*M, FC tntc*
2/16/95					L	NO B/N
3/2/95					L	NO B/N
3/30/95					H	NO B/N
4/6/95					L	NO B/N
4/25/95					H	NO B/N
5/11/95					E	NO B/N
6/26/95					HF	NO B/N
7/12/95					H	NO B/N
8/16/95					HF	NO B/N
11/18/95	60	22			HE	PF
2/1/96					HE	NO B/N
2/8/96	58				F	PF
3/28/96	432	424			LE	PF
5/9/96	40	20	400	*4.9*	LE	PF
GEOMEAN=	88.1	57.1	400.0	4.9		
STDEV	189.9	232.7				
COUNT	4	3	1	1		

WELL: WRH-2						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/3/95	*1160*	*808*	*153*	*330*	*H*	*M*
2/16/95					L	didn't samp
3/2/95					L	NO B/N
3/30/95					H	NO B/N
4/6/95	67.25	51	23	0.49	L	PF
4/25/95					H	NO B/N
5/11/95					E	NO B/N
6/26/95					HF	NO B
7/12/95					H	NO B/N
8/16/95					HF	NO B/N
11/18/95	6.5				HE	PF
2/1/96					HE	NO B/N
2/8/96	0.24	0.24	0.25	3.5	F	PF
3/28/96	0.24	0.24	0.24	3	LE	PF
5/9/96	0.24	0.24	0.24	1	LE	PF
GEOMEAN=	1.43	0.92	0.76	1.51		
STDEV	29.39	25.38	11.38	1.48		
COUNT	5	4	4	4		

ELL: WRH-3 DEEP						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*13*	*H*	*M*
2/16/95	*7*	*3*	*0.24*	*0.49*	*L*	*S*
3/2/95	0.24	0.24	0.24	0.24	L	PF
3/30/95	0.24	0.24	0.24	0.24	H	PF
4/6/95	0.24	0.24	0.24	0.24	L	PF
4/25/95	0.24	0.24	0.24	0.24	H	PF
5/11/95	1.5	1.5	0.24	0.24	E	PF
6/26/95	0.24	0.24	0.24	0.24	HF	PF
7/12/95	0.24	0.24	0.24	0.24	H	PF
8/16/95	0.24	0.24	0.25	0.24	HF	PF
11/14/95	0.24	0.24	0.24	0.24	H	PF
11/18/95	0.24	0.24	0.24	0.24	HE	PF
2/1/96	0.24	0.24	0.24	0.24	HE	PF
2/8/95	0.24	0.24	0.24	0.24	F	PF
3/28/96	0.24	0.24	0.24	0.24	LE	PF
5/9/96	0.24	0.24	0.24	0.25	LE	PF
GEOMEAN=	0.27	0.27	0.24	0.24		
STDEV	0.34	0.34	0.00	0.00		
COUNT	14	14	14	14		

WELL: WRH-4						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/3/95	*18*	*8*	*5*	*240*	*H*	*S*
2/16/95					L	didn't samp
3/2/95	390	205	185	0.24	L	PF
3/30/95	330	210	0.24	7	H	PF
4/6/95	350	200	20	6.75	L	PF
4/25/95	1055	950	1	29.25	H	PF
5/9/95					H	NO B
5/11/95	1380	1080	0.24	0.24	E	PF
6/26/95	3375	2100	9.25	73.75	HF	PF
7/12/95	615	175	0.5	3.25	H	PF
8/16/95	50	40	135.5	1.75	HF	PF
11/14/95	11	5	0.5	0.5	H	PF
11/18/95	14.5		73.33	0.24	HE	PF
2/1/96	210		14.25	0.24	HE	PF
2/8/96	15800	5700	475	0.75	F	PF
3/28/96	9000	9600	12.5	2	LE	PF
5/9/96	20000	10100	26	0.5	LE	PF
GEOMEAN=	591.03	611.80	8.53	1.69		
STDEV	6494.84	3466.22	130.15	20.13		
COUNT	14.00	12.00	14.00	14.00		

WELL: WRH-5						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/3/95	*21000*		*420*	*0*	*H*	*M, FC tntc*
2/16/95					L	didn't samp
3/2/95	35.5	29.25	12	0.24	L	PF
3/30/95					H	NO B
4/6/95	16.25	6.25	2.75	0.24	L	PF
4/25/95	2.75	2.25	3	0.24	H	PF
5/11/95					E	NO B
6/26/95					HF	NO B/N
7/12/95					H	NO B/N
8/16/95					HF	NO B/N
11/14/95					H	NO B
11/18/95	2130	600	8100	0.24	HE	PF
2/1/96					HE	NO B/N
2/8/96	400	250	64	*1.9*	F	PF
3/28/96	300	280	232	*1.9*	LE	PF
5/9/96	120	30	19	0.5	LE	PF
GEOMEAN=	90.22	46.94	41.89	0.48		
STDEV	766.21	191.72	3041.45	0.79		
COUNT	7.00	7.00	7.00	7.00		

WELL: WRH-6						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/3/95	*0*	*0*	*0*	*160*	*H*	*M*
2/16/95					L	didn't samp
3/2/95	0.24	0.24	0.24	0.24	L	PF
3/30/95	0.24	0.24	0.24	1.5	H	PF
4/6/95	0.24	0.24	0.24	1	L	PF
4/25/95	0.24	0.24	0.24	0.24	H	PF
5/11/95	0.24	0.24	0.24	0.25	E	PF
6/26/95	0.24	0.24	0.24	0.24	HF	PF
7/12/95	0.24	0.24	0.75	0.75	H	PF
8/16/95	0.24	0.24	0.24	0.24	HF	PF
11/18/95	0.24	0.24	0.24	0.24	HE	PF
2/1/96	0.24	0.24	0.24	0.24	HE	PF
2/8/96	0.24	0.24	0.25	0.24	F	PF
3/28/96	0.24	0.24	0.24	0.24	LE	PF
5/9/96	0.24	0.24	0.24	0.24	LE	PF
GEOMEAN=	0.24	0.24	0.28	0.34		
STDEV	0.00	0.00	0.14	0.40		
COUNT	13.00	13.00	13.00	13.00		

WELL: WRH-7						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
3/28/96	0.24	0.24	0.24	0.24	LE	PF
5/9/96	0.24	0.24	0.24	0.24	L	PF
GEOMEAN=	0.24	0.24	0.24	0.24		
COUNT	2	2	2	2		

WELL: WRH-8						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
3/28/96	0.24	0.24	0.24	0.24	LE	PF
5/9/96	0.24	0.24	0.24	0.24	L	PF
GEOMEAN=	0.24	0.24	0.24	0.24		
COUNT	2	2	2	2		

WELL: WRH-9						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
3/28/96	0.24	0.24	0.24	0.24	LE	PF
5/9/96	0.24	0.24	0.24	0.24	L	PF
GEOMEAN=	0.24	0.24	0.24	0.24		
COUNT	2	2	2	2		

WELL: WRH-10						
DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
3/28/96	0.24	0.24	0.24	0.24	LE	PF
5/9/96	0.24	0.24	0.24	0.24	L	PF
GEOMEAN=	0.24	0.24	0.24	0.24		
COUNT	2	2	2	2		

TABLE 8I: Site KDB-Nutrient Database

WELL: KDB-1

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.20	5.50	6.27		49.50		1/9/95	526.25	7.37	52.83	0.74	8.11	0.07	0.01	L	M
3/7/95	0.20	5.20		5.32	241.50	7.25	3/7/95	1163.04	16.28	16.58	0.23	16.51	0.03	0.00	L	PF
3/23/95	0.00		6.39	4.96	468.00	4.70	3/23/95	203.67	2.85	12.33	0.17	3.02	0.07	0.01	L	PF
4/4/95	0.00		6.34	5.48	1834.00	2.94	4/4/95	169.93	2.38	44.65	0.63	3.00	0.06	0.00	L	PF
5/2/95	0.00		6.49	5.83	66.00	10.61	5/2/95	339.31	4.75	33.96	0.48	5.23	0.04	0.00	L	PF
5/22/95	0.00		6.60	5.82	15.60	19.23	5/22/95	236.67	3.31	36.42	0.51	3.82	0.98	0.08	H	PF
6/21/95	0.00		6.61	6.49	254.80	1.26	6/21/95	1234.96	17.29	20.60	0.29	17.58	0.25	0.02	E	PF
7/17/95				7.91			7/17/95								L	NO B/N
8/21/95				8.38			8/21/95								H	NO B/N
10/19/95				7.51			10/19/95								E	NO B/N
2/29/96	0.00	3.20	6.30	4.30			2/29/96	554.84	7.77	45.80	0.64	8.41	0.17	0.01	E	PF
4/4/96	0.00	7.80	6.45	4.92			4/4/96	169.93	2.38	48.02	0.67	3.05	0.14	0.01	H	PF
5/30/96	0.00	11.40	6.54	5.50			5/30/96	116.05	1.62	26.92	0.38	2.00	0.41	0.03	H	PF
MEAN=	**0.04**	**6.62**	**6.44**	**6.04**			**MEAN=**		**6.60**		**0.47**	**7.07**		**0.017**		
MEDIAN	**0.00**	**5.50**	**6.45**	**5.68**			**MEDIAN**		**4.03**		**0.49**	**4.52**		**0.008**		
STDDEV	**0.08**	**3.13**	**0.13**	**1.28**			**STDDEV**		**5.76**		**0.20**	**5.69**		**0.023**		
N	**10**	**5**	**9**	**12**			**N**		**10**		**10**	**10**		**10**		

WELL: KDB-2

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95							1/9/95								L	didn't samp
3/7/95							3/7/95								L	didn't samp
3/23/95							3/23/95								L	didn't samp
4/4/95	0.00		6.20	5.90	658.00	4.26	4/4/95	631.92	8.85	10.05	0.14	8.99	0.04	0.00	L	PF
5/2/95	0.00		6.31	6.22	902.00	7.54	5/2/95	145.24	2.03	6.23	0.09	2.12	0.03	0.00	L	PF
5/22/95	0.00		6.25	6.17	75.00	4.80	5/22/95	81.69	1.14	8.45	0.12	1.26	0.76	0.06	H	PF
6/21/95	0.00		5.72	6.77	373.20	1.02	6/21/95	50.46	0.71	5.78	0.08	0.79	0.22	0.02	E	PF
7/17/95		16.50		8.00			7/17/95								L	NO B/N
8/21/95	0.00		7.17	8.30	30.50	13.11	8/21/95	14.96	0.21	11.97	0.17	0.38	2.37	0.19	H	PF
10/19/95		14.00		7.61			10/19/95								E	PF, NO N
2/29/96							2/29/96								E	No Sample
4/4/96							4/4/96								H	No Sample
5/30/96	0.00	11.50	6.49	5.85			5/30/96	50.39	0.71	4.79	0.07	0.77	0.24	0.02	H	PF
MEAN=	**0.00**	**14.00**	**6.36**	**6.85**	**407.74**	**6.15**	**MEAN=**		**2.27**		**0.11**	**2.38**		**0.048**		
MEDIAN	**0.00**	**14.00**	**6.28**	**6.50**	**373.20**	**4.80**	**MEDIAN**		**0.93**		**0.10**	**1.02**		**0.018**		
STDDEV	**0.00**	**2.50**	**0.47**	**0.98**	**374.55**	**4.53**	**STDDEV**		**3.28**		**0.04**	**3.29**		**0.071**		
N	**6**	**3**	**6**	**8**	**5**	**5**	**N**		**6**		**6**	**6**		**6**		

WELL: KDB-3

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.20	5.20	6.27		43.70		1/9/95	184.45	2.58	79.82	1.12	3.70	0.07	0.01	L	M
3/7/95	0.20	5.00		5.85	16.40	26.83	3/7/95	382.50	5.36	8.88	0.12	5.48	0.03	0.00	L	PF
3/23/95	0.00		5.83	5.57	182.00	5.05	3/23/95	488.65	6.84	15.19	0.21	7.05	0.03	0.00	L	PF
4/4/95	0.00		5.98	6.04	1248.00	5.29	4/4/95	266.12	3.73	49.52	0.69	4.42	0.04	0.00	L	PF
5/2/95	0.00		6.23	6.26	742.00	4.72	5/2/95	67.36	0.94	28.41	0.40	1.34	0.02	0.00	L	PF
5/22/95	0.00		6.19	6.23	274.33	3.65	5/22/95	123.53	1.73	47.45	0.66	2.39	0.75	0.06	H	PF
6/21/95	0.00		6.57	6.87	283.67	2.47	6/21/95	1789.43	25.05	138.25	1.94	26.99	0.23	0.02	E	NO B
7/17/95				8.20			7/17/95								L	NO B/N
8/21/95				8.40			8/21/95								H	NO B/N
10/19/95				7.58			10/19/95								E	NO B/N
2/29/96	0.00	3.10	6.84	5.12			2/29/96	960.32	13.44	110.70	1.55	14.99	0.11	0.01	E	PF
4/4/96	0.00	9.00	6.83	5.62			4/4/96	167.05	2.34	66.21	0.93	3.27	0.07	0.01	H	PF
5/30/96	0.00	12.20	6.75	6.04			5/30/96	50.15	0.70	15.33	0.21	0.92	0.30	0.02	H	PF
MEAN=	**0.04**	**6.90**	**6.39**	**6.49**			**MEAN=**		**6.27**		**0.78**	**7.06**		**0.013**		
MEDIAN	**0.00**	**5.20**	**6.27**	**6.14**			**MEDIAN**		**3.15**		**0.68**	**4.06**		**0.005**		
STDDEV	**0.08**	**3.66**	**0.37**	**1.06**			**STDDEV**		**7.61**		**0.61**	**8.08**		**0.018**		
N	**10**	**5**	**9**	**12**			**N**		**10**		**10**	**10**		**10**		

WELL: KDB-4

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95							1/9/95								L	NO B/N
3/7/95	0.20	6.00		6.04	35.40	12.99	3/7/95	1414.94	19.81	3.49	0.05	19.86	0.03	0.00	L	PF
3/23/95	0.00		6.37	5.73	4.00	30.00	3/23/95	1268.80	17.76	7.66	0.11	17.87	0.06	0.00	L	PF
4/4/95	0.00		6.54	6.18	267.00	9.74	4/4/95	1344.46	18.82	28.42	0.40	19.22	0.08	0.01	L	PF
5/2/95	0.00		6.20	6.46	279.00	9.68	5/2/95	1247.32	17.46	36.75	0.51	17.98	0.01	0.00	L	NO B
5/22/95	0.00		6.45	6.40	798.50	5.82	5/22/95	1317.87	18.45	28.40	0.40	18.85	0.77	0.06	H	NO B
6/21/95				7.08			6/21/95								E	NO B/N
7/17/95				8.00			7/17/95								L	NO B/N
8/21/95				8.47			8/21/95								H	NO B/N
10/19/95				7.64			10/19/95								E	NO B/N
2/29/96	0.00	3.90	6.99	5.31			2/29/96	943.32	13.21	84.00	1.18	14.38	0.10	0.01	E	PF
4/4/96	0.00	12.00	6.84	5.85			4/4/96	798.14	11.17	90.51	1.27	12.44	0.13	0.01	H	PF
5/30/96	0.00	14.50	6.70	6.31			5/30/96	876.37	12.27	48.79	0.68	12.95	0.23	0.02	H	PF
MEAN=	**0.03**	**9.10**	**6.59**	**6.62**			**MEAN=**		**16.12**		**0.57**	**16.69**		**0.014**		
MEDIAN	**0.00**	**9.00**	**6.54**	**6.36**			**MEDIAN**		**17.61**		**0.46**	**17.92**		**0.007**		
STDDEV	**0.07**	**4.97**	**0.28**	**0.97**			**STDDEV**		**3.35**		**0.46**	**2.96**		**0.020**		
N	**8**	**4**	**7**	**12**			**N**		**8**		**8**	**8**		**8**		

WELL: KDB-5							WELL: KDB-5									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95							1/9/95								L	NO B/N
3/7/95	0.80	5.00		4.00	155.25	3.86	3/7/95	1656.88	23.20	3.08	0.04	23.24	0.04	0.00	L	PF
3/23/95	0.00		6.02	3.48	58.00	3.10	3/23/95	1585.38	?2.20	4.11	0.06	22.25	0.05	0.00	L	PF
4/4/95	0.00		6.00	3.96	23.20	3.45	4/4/95	1823.24	25.53	15.04	0.21	25.74	0.07	0.01	L	PF
5/2/95	0.00		6.58		774.00	3.36	5/2/95	1100.43	15.41	11.17	0.16	15.56	0.12	0.01	L	PF
5/22/95	0.00		6.15	4.46	311.00	2.25	5/22/95	1378.24	19.30	13.29	0.19	19.48	0.79	0.06	H	PF
6/21/95	0.00		6.28	5.28	1402.00	0.93	6/21/95	1199.40	16.79	11.97	0.17	16.96	0.23	0.02	E	PF
7/17/95				6.51			7/17/95								L	NO B/N
8/21/95	0.00			6.87			8/21/95								H	NO B/N
10/19/95				5.60			10/19/95								E	PF, NO N
2/29/96	0.00	4.80	6.86	2.98			2/29/96	1247.64	17.47	60.67	0.85	18.32	0.19	0.01	E	PF
4/4/96	0.00	8.90	6.95	3.35			4/4/96	1214.21	17.00	74.74	1.05	18.05	0.04	0.00	H	PF
5/30/96	0.00	11.70	6.84	4.18			5/30/96	1301.01	18.21	48.86	0.68	18.90	0.25	0.02	H	PF
MEAN=	**0.08**	**7.60**	**6.46**	**4.61**			**MEAN=**		**19.45**		**0.38**	**19.83**		**0.015**		
MEDIAN	**0.00**	**6.95**	**6.43**	**4.18**			**MEDIAN**		**18.21**		**0.19**	**18.90**		**0.009**		
STDDEV	**0.25**	**3.32**	**0.40**	**1.29**			**STDDEV**		**3.42**		**0.38**	**3.27**		**0.019**		
N	**10**	**4**	**8**	**11**			**N**		**9**		**9**	**9**		**9**		

WELL: KDB-6							WELL: KDB-6									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.30	6.10	6.27		25.20		1/9/95	1397.04	19.56	22.23	0.31	19.87	0.11	0.01	L	M
3/7/95	0.20	5.50		5.53	14.75	21.19	3/7/95	1381.73	19.34	5.39	0.08	19.42	0.13	0.01	L	PF
3/23/95	0.00		6.18	5.24	79.00	3.04	3/23/95	1479.30	20.71	3.58	0.05	20.76	0.10	0.01	L	PF
4/4/95	0.00		5.83	5.80	6.40	12.50	4/4/95	1625.20	22.75	17.44	0.24	23.00	0.07	0.01	L	PF
5/2/95	0.00		6.81	6.23	14.80	10.81	5/2/95	1291.66	18.08	15.08	0.21	18.29	0.05	0.00	L	NO B
5/22/95	0.00		6.67	6.22	456.00	3.07	5/22/95	1351.58	18.92	41.74	0.58	19.51	0.77	0.06	H	NO B
6/21/95				6.99			6/21/95								HE	NO B/N
7/17/95		17.50		8.57			7/17/95								L	NO B/N
8/21/95				9.78			8/21/95								H	NO B/N
10/19/95				9.64			10/19/95								E	no H2O
2/29/96	0.00	4.50	7.68	4.65			2/29/96	1012.31	14.17	373.73	5.23	19.40	0.13	0.01	E	PF
4/4/96	0.00	9.50	7.27	5.23			4/4/96	1077.15	15.08	205.51	2.88	17.96	0.46	0.04	H	PF
5/30/96	0.00	13.50	7.61	6.10			5/30/96	1347.13	18.86	189.72	2.66	21.52	0.35	0.03	H	PF
MEAN=	**0.06**	**9.43**	**6.79**	**6.67**			**MEAN=**		**18.61**		**1.36**	**19.97**		**0.019**		
MEDIAN	**0.00**	**7.80**	**6.74**	**6.16**			**MEDIAN**		**18.92**		**0.31**	**19.51**		**0.010**		
STDDEV	**0.11**	**5.15**	**0.68**	**1.74**			**STDDEV**		**2.64**		**1.82**	**1.58**		**0.019**		
N	**9**	**6**	**8**	**12**			**N**		**9**		**9**	**9**		**9**		

WELL: KDB-7							WELL: KDB-7									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.30	6.00	6.27		33.00		1/9/95	1360.82	19.05	1.59	0.02	19.07	0.05	0.00	L	M
3/7/95	0.50	5.00		4.75	104.00	26.92	3/7/95	1401.56	19.62	8.84	0.12	19.75	0.05	0.00	L	PF
3/23/95	0.00		6.34	4.19	288.00	5.97	3/23/95	1702.88	23.84	13.44	0.19	24.03	0.04	0.00	L	PF
4/4/95	0.00		6.40	4.71	93.67	'7.83	4/4/95	1947.92	27.27	179.58	2.51	29.79	0.06	0.00	L	PF
5/2/95	0.00		6.77	5.22	602.00	3.65	5/2/95	1461.00	20.45	219.86	3.08	23.53	0.04	0.00	L	PF
5/22/95	0.00			5.20			5/22/95								H	NO B/N
6/21/95	0.00			6.01			6/21/95								HE	NO B/N
7/17/95				7.33			7/17/95								L	NO B/N
8/21/95				7.69			8/21/95								H	NO B/N
10/19/95				6.35			10/19/95								E	NO B/N
2/29/96	0.00	4.90	6.75	3.63			2/29/96	1120.51	15.69	21.48	0.30	15.99	0.14	0.01	E	PF
4/4/96	0.00	8.30	6.71	4.20			4/4/96	1502.02	21.03	278.33	3.90	24.92	0.05	0.00	H	PF
5/30/96	0.00	12.00	6.80	4.83			5/30/96	1744.73	24.43	483.20	6.76	31.19	0.40	0.03	H	PF
MEAN=	**0.08**	**7.24**	**6.58**	**5.34**			**MEAN=**		**21.42**		**2.11**	**23.53**		**0.008**		
MEDIAN	**0.00**	**6.00**	**6.71**	**5.02**			**MEDIAN**		**20.74**		**1.41**	**23.78**		**0.004**		
STDDEV	**0.18**	**2.99**	**0.23**	**1.26**			**STDDEV**		**3.62**		**2.43**	**5.22**		**0.010**		
N	**10**	**5**	**7**	**12**			**N**		**8**		**8**	**8**		**8**		

WELL: KDB-8							WELL: KDB-8									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95							1/9/95								L	NO WELL
3/7/95	0.50	4.80		5.59	23.80	8.40	3/7/95	1655.28	23.17	3.34	0.05	23.22	0.04	0.00	L	PF
3/23/95	0.00		5.84	5.06	55.60	7.55	3/23/95	1659.90	23.24	3.54	0.05	23.29	0.07	0.01	L	PF
4/4/95	0.00		5.75	5.70	128.00	9.69	4/4/95	1797.84	25.17	9.76	0.14	25.31	0.06	0.00	L	PF
5/2/95	0.00		5.92	6.31	272.33	2.69	5/2/95	1526.21	21.37	12.10	0.17	21.54	0.05	0.00	L	PF
5/22/95	0.00		6.00	6.10	543.00	2.21	5/22/95	1748.23	24.48	16.13	0.23	24.70	0.77	0.06	H	PF
6/21/95	0.00		6.39	7.68	6484.00	3.52	6/21/95	1695.58	23.74	62.07	0.87	24.61	0.24	0.02	E	NO B
7/17/95				9.01			7/17/95								L	NO B/N
8/21/95				9.28			8/21/95								H	NO B/N
10/19/95		17.00		8.15			10/19/95								E	PF, NO N
2/29/96	0.00	4.40	7.05	4.00			2/29/96	1240.48	17.37	58.09	0.81	18.18	0.21	0.02	E	PF
4/4/96	0.00	9.80	7.02	4.63			4/4/96	1310.42	18.35	77.15	1.08	19.43	0.07	0.01	H	PF
5/30/96	0.00	12.00	6.74	5.59			5/30/96	1414.76	19.81	133.81	1.87	21.68	0.40	0.03	H	PF
MEAN=	**0.06**	**9.60**	**6.34**	**6.43**	**1251.12**	**5.69**	**MEAN=**		**21.85**		**0.58**	**22.44**		**0.017**		
MEDIAN	**0.00**	**9.80**	**6.20**	**5.90**	**200.17**	**5.54**	**MEDIAN**		**23.17**		**0.23**	**23.22**		**0.006**		
STDDEV	**0.17**	**5.28**	**0.54**	**1.72**	**2570.58**	**3.24**	**STDDEV**		**2.78**		**0.62**	**2.45**		**0.019**		
N	**9**	**5**	**8**	**12**	**6**	**6**	**N**		**9**		**9**	**9**		**9**		

WELL: KDB-9 DEEP							WELL: KDB-9 DEEP									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95							1/9/95								L	NO WELL
3/7/95				4.80			3/7/95								L	NO B/N
3/23/95				1.67			3/23/95								L	NO B/N
4/4/94				4.48			4/4/94								L	NO B/N
5/2/95				10.04			5/2/95								L	NO B/N
5/22/95				5.11			5/22/95								H	NO B/N
6/21/95				5.47			6/21/95								HE	NO B/N
7/17/95		16.00		6.59			7/17/95								L	NO B/N
8/21/95				6.80			8/21/95								H	NO B/N
10/19/95				6.48			10/19/95								E	NO B/N
2/29/96	0.00	4.50		4.33			2/29/96								E	NO B/N
4/4/96	0.00	8.90		4.60			4/4/96								H	NO B/N
5/30/96	0.00	11.70		4.80			5/30/96								H	NO B/N
MEAN=				5.72			MEAN=									

WELL: KDB-10							WELL: KDB-10									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/4/96	0.00		8.88	0.90			4/4/96	26.99	0.38	8.33	0.12	0.49	1.62	0.13		
5/30/96	0.00	10.60	8.06	1.25			5/30/96	4.52	0.06	5.97	0.08	0.15	1.12	0.09		
MEAN=	0.00	10.60	8.47	1.08			MEAN=		0.22		0.10	0.32		0.108		
							MEDIAN		0.22		0.10	0.32		0.108		
							STDDEV		0.22		0.02	0.25		0.028		
							N		2.00		2.00	2.00		2.00		

WELL: KDB-11							WELL: KDB-11									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/4/96				7.53			4/4/96									No B/N
5/30/96	0.00	10.50	6.30	4.95			5/30/96	9.82	0.14	14.34	0.20	0.34	0.31	0.024		
							MEAN=									
							MEDIAN									
							STDDEV									
							N									

WELL: KDB-12							WELL: KDB-12									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/4/96	0.00		6.68	6.27			4/4/96	1069.44	14.97	58.18	0.81	15.79	0.18	0.01		
5/30/96	0.00	10.50	6.48	6.82			5/30/96	1089.12	15.25	60.47	0.85	16.09	0.30	0.02		
MEAN=	0.00	10.50	6.58	6.55			MEAN=		15.11		0.83	15.94		0.019		
							MEDIAN		15.11		0.83	15.94		0.019		
							STDDEV		0.19		0.02	0.22		0.006		
							N		2.00		2.00	2.00		2.00		

WELL: KDB-13							WELL: KDB-13									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/4/96	2.00		6.64	1.55			4/4/96	49.81	0.70	1193.02	16.70	17.40	0.05	0.004		No B
5/30/96		13.50		0.70			5/30/96									No B/N
							MEAN=									
							MEDIAN									
							STDDEV									
							N									

WELL: KDB-14							WELL: KDB-14									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/4/96				1.74			4/4/96	42.52	0.60	6.73	0.09	0.69	0.12	0.01		
5/30/96	0.00	11.50	7.11	1.50			5/30/96	1.12	0.02	4.97	0.07	0.09	0.27	0.02		
							MEAN=		0.31		0.08	0.39		0.015		
							MEDIAN		0.31		0.08	0.39		0.02		
							STDDEV		0.41		0.02	0.43		0.01		
							N		2.00		2.00	2.00		2.00		

WELL: KDB-15							WELL: KDB-15									
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
4/4/96				6.79			4/4/96									No B/N
5/30/96		9.70		5.69			5/30/96									No B/N
							MEAN=									
							MEDIAN									
							STDDEV									
							N									

WELL: KDB-LYSIMETER (MOM)

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM
8/21/95			7.47		14.40	38.89
9/18/95	0.00					
10/19/95						
11/14/95						
11/16/95						
1/30/96						
2/23/96						
2/29/96						
3/12/96						
3/13/96						
4/4/96						
4/11/96						
5/9/96						
5/30/96						
6/3/96						
6/5/96	0.00		4.84			
MEAN=	**0.00**		**6.16**		**14.40**	**38.89**

WELL: KDB-LYSIMETER (MOM)

DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
8/21/95	1386.57	19.41	1270.29	17.78	37.20	65.38	5.16	H	
9/18/95	1751.30	24.52	1233.05	17.26	41.78	92.13	7.28		
10/19/95									empty
11/14/95									10mls
11/16/95									30mls
1/30/96									empty
2/23/96									empty
2/29/96									empty
3/12/96									empty
3/13/96									empty
4/4/96									empty
4/11/96									empty
5/9/96									empty
5/30/96									no sample
6/3/96	1903.08	26.64	81.83	1.15	27.79	221.31	17.48		300mls
6/5/96	1757.96	24.61	86.62	1.21	25.82	266.34	21.04		300mls
MEAN=		**23.80**		**9.35**	**33.15**		**12.739**		
MEDIAN		**24.56**		**9.24**	**32.49**		**12.378**		
STDDEV		**3.08**		**9.44**	**7.60**		**7.714**		
N		**4**		**4**	**4**		**4**		

WELL: KDB-LYSIMETER (SON)

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM
8/21/96	0.00					
9/18/95						
10/19/95						
10/24/95	0.00					
11/1/95	0.00					
11/14/95	0.00		6.61			
11/16/95						
1/30/96						
2/22/96	0.00		6.95			
2/29/96	0.00		6.82			
3/12/96						
3/13/96						
4/4/96						
4/11/96	0.00		6.24			
5/9/96						
5/30/96						
6/3/96						
6/5/96						
MEAN=	**0.00**		**6.66**			
MEDIAN	**0.00**					
STDDEV	**0**					
N	**3**	**0**	**1**	**0**	**0**	**0**

WELL: KDB-LYSIMETER (SON)

DATE	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
8/21/96	1386.57	19.41	1270.29	17.78	37.20	65.38	5.16		400mls
9/18/95	1875.94	26.26	16.09	0.23	26.49	145.74	11.51		
10/19/95								E	NO N
10/24/95	1508.38	21.12	4.26	0.06	21.18	219.87	17.37		
11/1/95	1415.88	19.82	1.93	0.03	19.85	177.87	14.05		
11/14/95	1319.48	18.47	6.66	0.09	18.57	156.43	12.35		
11/16/95									100mls
1/30/96									20mls
2/22/96	1345.30	18.83	1116.65	15.63	34.47	180.47	14.25		
2/29/96	1228.89	17.20	1159.23	16.23	33.43	279.69	22.09		
3/12/96									5mls
3/13/96									empty
4/4/96									empty
4/11/96	1427.67	19.99	492.17	6.89	26.88	189.00	14.93		
5/9/96									empty
5/30/96									no sample
6/3/96									empty
6/5/96									empty
MEAN=		**20.14**		**7.12**	**27.26**		**13.964**		
MEDIAN		**19.62**		**3.56**	**26.68**		**14.151**		
STDDEV		**2.73**		**8.16**	**7.14**		**4.850**		
N		**8**		**8**	**8**		**8**		

TABLE 8I: Site KDB-Microbiological Database

WELL: KDB-1

DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95	*0*	*0*		*10*	*L*	*M*
3/7/95	0.24	0.24	0.24	0.24	L	FF
3/23/95	0.24	0.24	0.24	1	L	FF
4/4/95	0.24	0.24	0.24	0.25	L	FF
5/2/95	0.24	0.24	0.24	0.25	L	FF
5/22/95	0.24	0.24	0.24	0.25	H	FF
6/21/95	0.49	0.49	0.49	0.49	E	FF
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95					E	NO B/N
2/29/96	0.24	0.24	0.24	0.5	E	FF
4/4/96	0.24	0.24	0.24	0.24	HF	FF
5/30/96	0.25	0.24	0.24	0.24	H	FF
GEOMEAN=	**0.26**	**0.26**	**0.26**	**0.33**		
STDEV	**0.08**	**0.08**	**0.08**	**0.26**		
COUNT	**9.00**	**9.00**	**9.00**	**9.00**		

WELL: KDB-2

DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95					L	didn't samp
3/7/95					L	didn't samp
3/23/95					L	didn't samp
4/4/95	0.24	0.24	0.24	14.25	L	FF
5/2/95	0.24	0.24	0.24	2	L	FF
5/22/95	0.24	0.24	0.24	2.25	H	FF
6/21/95	0.24	0.24	0.24	0.5	E	FF
7/17/95					L	NO B/N
8/21/95	0.09	0.09	0.09	0.09	H	NO B/N
10/19/95	0.24	0.24	0.24	0.25	E	PF, NO N
2/29/96					E	NO SAMPLE
4/4/96					H	NO SAMPLE
5/30/96	0.24	0.24	0.24	7.5	H	FF
GEOMEAN=	**0.21**	**0.21**	**0.21**	**1.27**		
STDEV	**0.06**	**0.06**	**0.06**	**5.28**		
COUNT	**7.00**	**7.00**	**7.00**	**7.00**		

WELL: KDB-3

DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95	*860*	*615*		*115*	*L*	*M*
3/7/95	75	71.5	0.24	0.24	L	FF
3/23/95	1.5	1.5	0.24	0.25	L	FF
4/4/95	0.24	0.24	0.24	0.5	L	FF
5/2/95	0.24	0.24	0.24	0.75	L	FF
5/22/95	0.24	0.24	0.24	0.24	H	FF
6/21/95					E	NO B
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95					E	NO B/N
2/29/96	1.5	0.24	0.49	0.5	E	FF
4/4/96	0.49	0.49		51	HF	FF
5/30/96	0.24	0.24	0.24	3.25	H	FF
GEOMEAN=	**0.85**	**0.67**	**0.27**	**0.90**		
STDEV	**26.30**	**25.12**	**0.09**	**17.77**		
COUNT	**8.00**	**8.00**	**7.00**	**8.00**		

WELL: KDB-4

DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95					L	NO B/N
3/7/95	0.24	0.24	0.24	0.24	L	FF
3/23/95	0.24	0.24	0.24	0.24	L	FF
4/4/95	0.24	0.24	0.24	0.24	L	FF
5/2/95					L	NO B
5/22/95					H	NO B
6/21/95					E	NO B/N
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95					E	NO B/N
2/29/96	0.49	0.49			E	FF
4/4/96	0.49	0.49			HF	FF
5/30/96	0.49	0.49	0.09	0.49	H	FF
GEOMEAN=	**0.34**	**0.34**	**0.19**	**0.29**		
STDEV	**0.14**	**0.14**	**0.08**	**0.13**		
COUNT	**6.00**	**6.00**	**4.00**	**4.00**		

WELL: KDB-5

DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95					L	NO B/N
3/7/95	0.24	0.24	0.24	0.24	L	FF
3/23/95	0.24	0.24	0.24	0.24	L	FF
4/4/95	0.24	0.24	0.24	0.24	L	FF
5/2/95	0.24	0.24	0.24	0.24	L	FF
5/22/95	0.24	0.24	0.24	0.25	H	FF
6/21/95	0.24	0.24	0.24	0.24	E	FF
7/17/95					L	NO B/N
8/21/95	0.09	0.09	*1.9*		H	NO B/N
10/19/95	0.24	0.24	0.24	0.24	E	PF, NO N
2/29/96	0.24	0.24	0.24	0.24	E	FF
4/4/96	0.24	0.24	0.24	0.25	HF	FF
5/30/96	0.24	0.24	0.24	2.25	H	FF
GEOMEAN=	**0.22**	**0.22**	**0.29**	**0.30**		
STDEV	**0.05**	**0.05**	**0.50**	**0.63**		
COUNT	**11.00**	**11.00**	**11.00**	**10.00**		

WELL: KDB-6

DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95	*0*	*0*		*5*	*L*	*M*
3/7/95	7.5	7.25	1.75	0.24	L	FF
3/23/95	0.24	0.24	0.24	0.25	L	FF
4/4/95	0.24	0.24	0.24	0.5	L	FF
5/2/95					L	NO B
5/22/95					H	NO B
6/21/95					HE	NO B/N
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95					E	not a drop
2/29/96	6	6			E	FF
4/4/96	0.49	0.49			HF	FF
5/30/96	0.49	0.49			H	FF
GEOMEAN=	**0.92**	**0.92**	**0.47**	**0.31**		
STDEV	**3.33**	**3.26**	**0.87**	**0.15**		
COUNT	**6.00**	**6.00**	**3.00**	**3.00**		

WELL: KDB-7						
DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95	*0*	*0*		*0*	*L*	*M*
3/7/95	1	1	1	0.24	L	PF
3/23/95	0.24	0.24	0.24	1.5	L	PF
4/4/95	0.24	0.24	0.24	0.25	L	PF
5/2/95	0.24	0.24	0.24	0.24	L	PF
5/22/95					H	NO B/N
6/21/95					HE	NO B/N
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95					E	NO B/N
2/29/96	*0.24*	*0.24*	*0.24*	*0.5*	*E*	PF
4/4/96	0.24	0.24	0.24	0.24	HF	PF
5/30/96	0.24	0.24	0.25	0.5	H	PF
GEOMEAN=	**0.29**	**0.29**	**0.30**	**0.39**		
STDEV	**0.29**	**0.29**	**0.29**	**0.46**		
COUNT	**7.00**	**7.00**	**7.00**	**7.00**		

WELL: KDB-8						
DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95					L	NO WELL
3/7/95	0.24	0.24	0.24	0.24	L	PF
3/23/95	0.24	0.24	0.76	1	L	PF
4/4/95	0.24	0.24	0.24	0.24	L	PF
5/2/95	0.24	0.24	0.24	0.24	L	PF
5/22/95	0.24	0.24	0.24	0.25	H	PF
6/21/95					E	NO B
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95	0.25	0.24	0.24	0.24	E	PF, NO N
2/29/96	0.24	0.24	0.24	0.24	E	PF
4/4/96	0.09	0.09	0.49	1	HF	PF
5/30/96	0.24	0.24	0.24	2.25	H	PF
GEOMEAN=	**0.22**	**0.22**	**0.29**	**0.42**		
STDEV	**0.05**	**0.05**	**0.18**	**0.69**		
COUNT	**9**	**9**	**9**	**9**		

WELL: KDB-9 DEEP						
DATE	FC	EC	Ent	CP	TIDE	FILTER
1/9/95					L	NO WELL
3/7/95					L	NO B/N
3/23/95					L	NO B/N
4/4/94					L	NO B/N
5/2/95					L	NO B/N
5/22/95					H	NO B/N
6/21/95					HE	NO B/N
7/17/95					L	NO B/N
8/21/95					H	NO B/N
10/19/95					E	NO B/N
4/4/96					HF	NO B/N
5/30/96					H	NO B/N

WELL: KDB-10						
DATE	FC	EC	Ent	CP	TIDE	FILTER
4/4/96					HF	NO B
5/30/96	*1.2*	*1.2*	0.49	0.49	H	PF
GEOMEAN=	**1.2**	**1.2**	**0.49**	**0.49**		
COUNT	**1**	**1**	**1**	**1**		

WELL: KDB-11						
DATE	FC	EC	Ent	CP	TIDE	FILTER
4/4/96					HF	NO B
5/30/96					H	NO B/N

WELL: KDB-12						
DATE	FC	EC	Ent	CP	TIDE	FILTER
4/4/96	0.49	0.49			HF	PF
5/30/96	0.49	0.49	0.49	0.49	H	PF
GEOMEAN=	**0.49**	**0.49**	**0.49**	**0.49**		
COUNT	**2**	**2**	**1**	**1**		

WELL: KDB-13						
DATE	FC	EC	Ent	CP	TIDE	FILTER
4/4/96					HF	NO B
5/30/96					H	NO B/N
GEOMEAN=						
COUNT						

WELL: KDB-14						
DATE	FC	EC	Ent	CP	TIDE	FILTER
4/4/96	0.49	0.49			HF	PF
5/30/96	0.24	0.24	0.24	0.24	H	PF
GEOMEAN=	**0.34**	**0.34**	**0.24**	**0.24**		
STDEV	**0.18**	**0.18**				
COUNT	**2**	**2**	**1**	**1**		

WELL: KDB-15						
DATE	FC	EC	Ent	CP	TIDE	FILTER
4/4/96					HF	NO B/N
5/30/96					H	NO B/N

TABLE 8J: Site FDC-Nutrient Database															
WELL: FDC-1															
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.50	3.80												N/A	M, NO N
3/9/95				6.00										N/A	NO B/N
4/6/95				6.15										N/A	NO B/N
5/2/95				6.43										N/A	NO B/N
5/22/95				6.28										N/A	NO B/N
6/5/95				6.54										N/A	NO B/N
6/21/95				6.51											NO B/N
7/17/95				7.31											NO B/N
8/21/95				7.35											NO B/N
11/14/95	0.00			5.20			1337.98	18.73	292.38	4.09	22.83	0.10	0.01		PF, NO B
MEAN	0.25	3.80		6.42				18.73		4.09	22.83		0.01		
MEDIAN	0.25	3.80		6.43				18.73		4.09	22.83		0.01		
STDDEV	0.35			0.66											
N	2	1	0	9	0	0		1		1	1	1	1		
WELL: FDC-2															
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.90	4.30	6.61		115.60		2003.05	28.04	1324.10	18.54	46.58	0.78	0.06	N/A	M
3/9/95	0.80	3.80		4.42	4230.00	3.40	176.21	2.47	7.71	0.11	2.57	0.15	0.01	N/A	PF
4/6/95				4.82										N/A	NO B/N
5/2/95				5.22										N/A	NO B/N
5/22/95				5.15										N/A	NO B/N
6/5/95				5.23										N/A	NO B/N
6/21/95				5.30											NO B/N
7/17/95				6.22											NO B/N
8/21/95				7.15											NO B/N
11/14/95	0.00			4.15			858.73	12.02	113.26	1.59	13.61	0.14	0.01		PF, NO B
MEAN	0.57	4.05	6.61	5.30	2172.80	3.40		14.18		6.74	20.92		0.03		
MEDIAN	0.80	4.05	6.61	5.22	2172.80	3.40		12.02		1.59	13.61		0.01		
STDDEV	0.49	0.35		0.91	2909.32			12.92		10.24	22.90		0.03		
N	3	2	1	9	2	1		3		3	3		3		

WELL: FDC-6															
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.20	7.00	6.61		25.20		1.45	0.02	1.94	0.03	0.05	0.82	0.06	N/A	M
3/9/95	0.60	5.80		5.32	39.25	1.81	5.10	0.07	1.08	0.02	0.09	0.06	0.01	N/A	PF
4/6/95	0.00	6.00	6.43	6.20	30.80	4.64	0.00	0.00	1.34	0.02	0.02	0.03	0.00	N/A	PF
5/2/95	0.00		6.36	6.20	206.67	1.80	4.00	0.07	2.74	0.04	0.11	0.17	0.01	N/A	PF
5/22/95	0.00		6.32	6.10	313.67	2.67	1.06	0.01	2.77	0.04	0.06	0.80	0.06	N/A	PF
6/5/95	0.00		6.40	6.67	6037.67	0.96	5.01	0.07	0.72	0.01	0.08	0.12	0.01	N/A	PF
6/21/95	0.00		6.30	6.77	462.80	22.38	5.55	0.08	1.11	0.02	0.09	0.28	0.02		PF
7/17/95	0.00		7.12	7.43	3.40	35.29	2.11	0.03	3.11	0.04	0.07	0.48	0.04		PF
8/21/95	0.00		6.67	7.80	5.20	23.08	1.50	0.02	3.38	0.05	0.07	0.44	0.03		PF
11/14/95	0.00			5.70			9.96	0.14	20.13	0.28	0.42	0.25	0.02		PF
MEAN	0.07	6.27	6.55	6.46	800.37	11.60		0.05		0.05	0.10		0.03		
MEDIAN	0.00	6.00	6.44	6.20	30.25	3.76		0.05		0.03	0.08		0.02		
STDDEV	0.16	0.84	0.30	0.74	1871.13	13.36		0.04		0.08	0.11		0.02		
N	10	3	8	9	9	8		10		10	10		10		
WELL: FDC-4 LYSIMETER															
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
9/19/95	0.00						2308.01	33.43	21.73	0.30	33.74	0.75	0.06		
MEAN															
MEDIAN															
STDDEV															
N															

WELL: FDC-3															
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.50	6.00	6.61		20.90		83.98	1.18	16.58	0.22	1.30	0.16	0.01	N/A	M
3/9/95	0.80	6.00		5.59	129.33	4.64	1849.10	26.80	388.64	6.10	31.05	0.05	0.00	N/A	PF
4/6/95				8.03										N/A	NO B/N
5/2/95				8.54										N/A	NO B/N
5/22/95				8.06										N/A	NO B/N
6/5/95				8.30										N/A	NO B/N
6/21/95				7.93										N/A	NO B/N
7/17/95				9.13											NO B/N
8/21/95				9.017											NO B/N
11/14/95	0.00			5.59			1398.02	19.84	809.04	13.65	33.39	0.45	0.04		PF, NO B
MEAN	0.43	6.00	6.61	6.64	75.12	4.64		15.84		6.41	21.94		0.02		
MEDIAN	0.50	6.00	6.61	8.22	75.12	4.64		19.84		6.10	31.05		0.01		
STDDEV	0.40	0.00		1.23	76.67			12.63		6.90	17.84		0.02		
N	3	2	1	8	2	1		3		3	3		3		
WELL: FDC-4															
DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	1.00	1.80	6.61											N/A	M
3/9/95	0.40	2.50		5.10										N/A	NO B/N
4/6/95				5.21										N/A	NO B/N
5/2/95				5.68										N/A	NO B/N
5/22/95				5.33										N/A	NO B/N
6/5/95				5.75										N/A	NO B/N
6/21/95				5.61											NO B/N
7/17/95				8.63											NO B/N
8/21/95				8.75											NO B/N
11/14/95	0.00			4.80			1152.99	16.14	1346.69	18.84	34.98	0.07	0.01		PF, NO B
MEAN	0.47	2.15	6.61	5.99				16.14		18.84	34.98		0.01		
MEDIAN	0.40	2.15	6.61	5.66				16.14		18.84	34.98		0.01		
STDDEV	0.50	0.49		0.70											
N	3	2	1	9	0	0		1		1	1		1		

WELL: FDC-3

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.50	6.00	6.61		20.90		83.98	1.18	15.56	0.22	1.39	0.16	0.01	N/A	M
3/9/95	0.80	6.00		5.59	129.33	4.64	1849.10	25.89	368.64	5.16	31.05	0.05	0.00	N/A	PF
4/6/95				6.03										N/A	NO B/N
5/2/95				6.54										N/A	NO B/N
5/22/95				6.05										N/A	NO B/N
6/5/95				6.39										N/A	NO B/N
6/21/95				7.83											NO B/N
7/17/95				9.13											NO B/N
8/21/95				9.01?											NO B/N
11/14/95	0.00			5.58			1396.02	19.54	989.04	13.85	33.39	0.45	0.04		PF, NO B
MEAN	0.43	6.00	6.61	6.64	75.12	4.64		15.54		6.41	21.94		0.02		
MEDIAN	0.50	6.00	6.61	6.22	75.12	4.64		19.54		5.16	31.05		0.01		
STDDEV	0.40	0.00		1.23	76.67			12.83		6.90	17.84		0.02		
N	3	2	1	8	2	1		3		3	3		3		

WELL: FDC-4

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	1.00	1.80	6.61											N/A	M
3/9/95	0.40	2.50		5.10										N/A	NO B/N
4/6/95				5.21										N/A	NO B/N
5/2/95				5.66										N/A	NO B/N
5/22/95				5.33										N/A	NO B/N
6/5/95				5.75										N/A	NO B/N
6/21/95				5.81											NO B/N
7/17/95				6.83											NO B/N
8/21/95				6.75											NO B/N
11/14/95	0.00			4.80			1152.99	16.14	1345.69	18.84	34.98	0.07	0.01		PF, NO B
MEAN	0.47	2.15	6.61	5.69				16.14		18.84	34.98		0.01		
MEDIAN	0.40	2.15	6.61	5.66				16.14		18.84	34.98		0.01		
STDDEV	0.50	0.49		0.70											
N	3	2	1	9	0	0		1		1	1		1		

WELL: FDC-5

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
1/9/95	0.20	7.00	6.61		25.20		1.45	0.02	1.94	0.03	0.05	0.82	0.06	N/A	M
3/9/95	0.50	5.80		5.32	39.25	1.91	5.10	0.07	1.08	0.02	0.09	0.09	0.01	N/A	PF
4/6/95	0.00	6.00	6.43	6.20	30.20	4.64	0.00	0.00	1.34	0.02	0.02	0.03	0.00	N/A	PF
5/2/95	0.00		6.36	6.29	295.67	1.80	4.88	0.07	2.74	0.04	0.11	0.17	0.01	N/A	PF
5/22/95	0.00		6.32	6.10	313.67	2.87	1.05	0.01	2.77	0.04	0.05	0.80	0.06	N/A	PF
6/5/95	0.00		6.48	6.57	6037.67	0.86	5.01	0.07	0.72	0.01	0.08	0.12	0.01	N/A	PF
6/21/95	0.00		6.39	6.77	452.20	22.38	5.55	0.08	1.11	0.02	0.09	0.28	0.02		PF
7/17/95	0.00		7.12	7.43	3.40	35.29	2.11	0.03	3.11	0.04	0.07	0.48	0.04		PF
8/21/95	0.00		6.67	7.60	5.20	23.08	1.50	0.02	3.36	0.05	0.07	0.44	0.03		PF
11/14/95	0.00			5.79			9.96	0.14	20.13	0.28	0.42	0.25	0.02		PF
MEAN	0.07	6.27	6.55	6.45	800.27	11.60		0.05		0.05	0.10		0.03		
MEDIAN	0.00	6.00	6.46	6.29	39.25	3.76		0.05		0.03	0.08		0.02		
STDDEV	0.16	0.64	0.28	0.74	1971.13	13.30		0.04		0.08	0.11		0.02		
N	10	3	8	9	9	8		10		10	10		10		

WELL: FDC-LYSIMETER

DATE	SAL	TEMP	pH	H20 DEPTH	TSS	% OM	NO3	NO3-N	NH4	NH4-N	DIN	PO4	PO4	TIDE	FILTER
9/18/95	0.00						2388.01	33.43	21.73	0.30	33.74	0.75	0.06		
MEAN															
MEDIAN															
STDDEV															
N															

TABLE 8J: Site FDC-Microbiological Database

WELL: FDC-1

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/9/95	0	0		160	N/A	M, NO N
3/9/95					N/A	NO B/N
4/6/95					N/A	NO B/N
5/2/95					N/A	NO B/N
5/22/95					N/A	NO B/N
6/5/95					N/A	NO B/N
6/21/95						NO B/N
7/17/95						NO B/N
8/21/95						NO B/N
11/14/95						PF, NO B

WELL: FDC-2

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/9/95	0	0		25	N/A	M
3/9/95	0.5	0.5	0	0	N/A	PF
4/6/95					N/A	NO B/N
5/2/95					N/A	NO B/N
5/22/95					N/A	NO B/N
6/5/95					N/A	NO B/N
6/21/95						NO B/N
7/17/95						NO B/N
8/21/95						NO B/N
11/14/95						PF, NO B

WELL: FDC-3

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/9/95	0	0		0	N/A	M
3/9/95	0	0	0	0	N/A	PF
4/6/95					N/A	NO B/N
5/2/95					N/A	NO B/N
5/22/95					N/A	NO B/N
6/5/95					N/A	NO B/N
6/21/95						NO B/N
7/17/95						NO B/N
8/21/95						NO B/N
11/14/95						PF, NO B

WELL: FDC-4

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/9/95	0	0		50	N/A	M
3/9/95					N/A	NO B/N
4/6/95					N/A	NO B/N
5/2/95					N/A	NO B/N
5/22/95					N/A	NO B/N
6/5/95					N/A	NO B/N
6/21/95						NO B/N
7/17/95						NO B/N
8/21/95						NO B/N
11/14/95						PF, NO B

WELL: FDC-5

DATE	FC	EC	Enteroccoci	CP	TIDE	FILTER
1/9/95	0	0		0	N/A	M
3/9/95	0.25	0.25	0	0	N/A	PF
4/6/95	0	0	0	0	N/A	PF
5/2/95	0	0	0	0	N/A	PF
5/22/95	0	0	0	0.25	N/A	PF
6/5/95	0	0	0	0	N/A	PF
6/21/95	0	0	0	0		PF
7/17/95	3	0.5	1.5	1		PF
8/21/95	0	0.25	0	0		PF
11/14/95	0	0	0	0		PF

TABLE 9

SEABROOK SAMPLING DATES

						SITES						
DATE	TIDE(11am)	REH	RET	RB	RH	RP	RC	CSL	WRH	FDC	KDB	SSW
12/7/94	LF	1	1	1	1							
1/3/95	HF							1	1			
1/9/95	L									1	1	
1/16/95	H					1	1					
2/7/95	L	2	2	2								
2/9/95	LE				2	2	2					
2/16/95	H							•	•			
2/23/95	L							2				
3/2/95	H								2			
3/7/95	LF										2	
3/9/95	L									2		
3/13/95	HE	3	3									
3/15/95	H			3	3	3						
3/23/95	L						3				3	
3/30/95	H							3	3			
4/4/95	LF										4	
4/6/95	L								4	3		
4/13/95	H	4	4									
4/18/95	LF			4	4							
4/20/95	L					4	4					
4/25/95	HE							4	5			
5/2/95	F									4	5	
5/4/95	LF	5	5									
5/9/95	LE								•			
5/11/95	HE							5	6			
5/18/95	LF					5	5					
5/22/95	LE									5	6	
5/24/95	HE				5	6	6					
5/31/95	F	6	6	5								
6/5/95	L							6		6		
6/6/95	L			6	6							
6/8/95	L											1
6/12/95	H	7	7	7								
6/14/95	HF				7	7	7					
6/19/95	L											2
6/21/95	LE									7	7	
6/22/95	L											3
6/26/95	H							7	7			
7/5/95	L	8	8	8								
7/10/95	H				8	8	8					
7/11/95	L											4
7/12/95	H							8	8			
7/17/95	L									8	8	
7/18/95	L	9	9	9								
7/19/95	L											5
7/24/95	H				9	9						
DATE	TIDE	REH	RET	RB	RH	RP	RC	CSL	WRH	FDC	KDB	SSW
8/2/95	L	10	10									
8/14/95	L											6
8/16/95	L							9	9			
8/21/95	HE									9	9	
8/23/95	H			10			9					
10/5/95	HE	11										1,2
10/10/95	HF		11	11								
10/19/95	E										10	8,9
10/26/95	HF							10				
10/27/95	L											7
10/31/95	L											13,14,15
11/7/95	H				10	10						
11/14/95	LF								10	10		
11/16/95	L						10					
11/18/95	E								11			
12/5/95	H					11	11					
12/28/95	L	12										
1/30/96	E											8
2/1/96	HE								12			
2/8/96	F								13			
2/20/96	HF				11							
2/22/96	F							11				5,7
2/29/96	E										11	8,9
3/12/96	L			12			12					
3/13/96	L											9
3/28/96	LE								14			3,4
4/4/96	H										12	3,4,5,7
4/11/96	LE							12				
4/18/96	HF	13										
4/23/96	L					12						
4/26/96	LE				12		13					
5/2/96	H		12									
5/7/96	LF							13				3,5,7
5/9/96	L								15			3,4
5/23/96	L	14										1,2
5/28/96	E				13							
5/30/96	H										13	8,9
6/3/96	HF							14				5,7
6/5/96	L											10

Table 10. Ranges of contaminant concentrations from all wells at each site

Site	Salinity PPT	Fecal coliforms CFU/100 ml	Enterococci CFU/100 ml	*C. perfringens* CFU/100 ml	Nitrate mg/L	Ammonium mg/L	Phosphate mg/L	Average NO3/NH4 ratio*
			River	**Street**				
REH	3 to 15	0 to 29	0-0.5	0 to 700	<0.01 to 15.3	0.56 to 21.5	<0.01 to 0.97	0.12
RET	0 to 4	0 to 1400	0 to 40	0 to 16,000	<0.01 to 3.0	0.23 to 18.9	<0.01 to 0.62	0.15
RB	4 to 26	0 to 65	0 to 830	0 to 875	<0.01 to 0.7	0.25 to 11.15	<0.01 to 1.2	0.26
RH	2 to 17	0 to 19,000	0 to 350	0 to 285	<0.01 to 25.7	0.05 to 9.78	0.01 to 8.9	2.1
RP	3 to 17	0 to 71	0 to 100	0 to 60	<0.01 to 13.8	0.20 to 9.9	<0.01 to 8.4	0.56
RC	2 to 16	0 to 1140	0 to 4100	0 to 390	0.01 to 25.7	0.15 to 18.3	0.01 to 6.9	0.65
			In	**Town**				
CSL	0	0 to 53	0 to 76	0 to 490	0.33 to 17.9	<0.01 to 17.8	<0.01 to 0.42	17.4
WRH	0 to 1	0 to 21,000	0 to 420	0 to 330	<0.01 to 20.9	0.02 to 22.0	<0.01 to 1.7	12.4
KDB	0 to 1	0 to 860	0 to 2	0 to 115	0.94 to 27.3	0.02 to 6.8	<0.01 to 0.19	16.1
FDC	0 to 1	0 to 1	0 to 1.5	0 to 160	<0.01 to 28	0.01 to 18.8	<0.01 to 0.06	2.2

* The ratios for mean nitrate divided by mean ammonium levels for each well were calculated, summed, and averaged for each site.

			TABLE 11							
SEABROOK SURFACE WATER: NUTRIENT DATABASE										
BOLD = mg/L										
SITE: SSW 1 (REH DOWN STREAM)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.73	46.20	16.88	0.60	0.01	13.78	0.19	0.20	0.24	0.02
6/22/95		56.40	13.83	0.15	0.00	41.59	0.58	0.58	1.24	0.10
7/11/95	7.48	25.80	18.60	1.79	0.03	63.34	0.89	0.91	1.21	0.10
7/19/95	7.87	66.80	14.37	0.10	0.00	5.85	0.08	0.08	0.89	0.07
8/14/95	8.00	10.50	20.95	3.65	0.05	6.80	0.10	0.15	0.36	0.03
10/5/95				0.93	0.01	5.80	0.08	0.09	0.45	0.04
1/30/96	7.52			4.49	0.06	9.00	0.13	0.19	0.41	0.03
3/13/96	7.64			0.39	0.01	8.44	0.12	0.12	0.49	0.04
5/23/96	7.44			2.55	0.04	9.19	0.13	0.16	0.97	0.08
6/5/96	7.16			3.88	0.05	17.63	0.25	0.30	0.89	0.07
6/11/96	7.56			1.73	0.02	26.91	0.38	0.40	1.89	0.15
MEAN=	**7.60**				**0.03**		**0.27**	**0.29**		**0.06**
SITE: SSW 2 (REH UP STREAM)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.61	15.00	18.67	1.48	0.02	22.66	0.32	0.34	0.12	0.01
6/22/95		15.60	19.23	2.94	0.04	10.90	0.15	0.19	0.61	0.05
7/11/95	7.48	6.80	26.47	2.73	0.04	9.91	0.14	0.18	0.67	0.05
7/19/95	7.40	6.00	22.92	2.26	0.03	11.93	0.17	0.20	0.44	0.03
8/14/95	8.02	8.20	19.51	2.18	0.03	4.90	0.07	0.10	0.43	0.03
10/5/95				22.73	0.32	3.61	0.05	0.37	0.57	0.04
10/27/95	7.24	5.60	10.71	6.79	0.10	3.93	0.06	0.15	0.93	0.07
1/30/96	7.60			11.03	0.15	3.31	0.05	0.20	0.45	0.04
3/13/96	7.97			0.39	0.01	2.52	0.04	0.04	0.49	0.04
5/23/96	7.36			2.83	0.04	3.41	0.05	0.09	0.66	0.05
6/5/96	7.09			2.24	0.03	5.38	0.08	0.11	0.56	0.04
6/11/96	7.33			2.22	0.03	12.12	0.17	0.20	1.13	0.09
MEAN=	**7.51**				**0.07**		**0.11**	**0.18**		**0.05**
SITE: SSW3 (CAUSEWAY STREET BRIDGE)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.38	3.80	47.37	43.11	0.60	4.24	0.06	0.66	0.14	0.01
6/22/95				24.58	0.34	4.05	0.06	0.40	0.37	0.03
7/11/95	7.26	6.40	34.38	11.92	0.17	17.89	0.25	0.42	0.66	0.05
7/19/95	7.19	5.00	32.00	14.29	0.20	4.98	0.07	0.27	0.11	0.01
8/14/95	7.80	20.00	21.00	1.65	0.02	13.15	0.18	0.21	0.20	0.02
10/27/95	7.29	4.00	50.00	10.96	0.15	4.01	0.06	0.21	0.32	0.03
1/30/96	7.14			75.95	1.06	3.56	0.05	1.11	0.08	0.01
2/8/96	7.00			166.44	2.33	15.33	0.21	2.54	1.29	0.10
3/13/96	7.39			132.52	1.86	13.06	0.18	2.04	0.21	0.02
3/28/96	7.07			106.07	1.48	8.64	0.12	1.61	0.10	0.01
4/11/96	7.04			63.89	0.89	5.15	0.07	0.97	3.28	0.26
5/7/96	7.08			50.65	0.71	2.68	0.04	0.75	0.12	0.01
5/9/96	7.32			66.47	0.93	3.49	0.05	0.98	0.67	0.05
6/5/96	7.23			53.65	0.75	3.96	0.06	0.81	0.15	0.01
6/11/96	7.42			15.78	0.22				0.35	0.03
MEAN=	**7.84**				**0.78**		**0.10**	**0.93**		**0.04**

SITE: SSW 4 (TIDAL CREEK BEHIND HUBERT)										
DATE	pH	TSS	%ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95								0.00		
6/19/95	7.56	20.20	18.81	65.93	0.92	6.74	0.09	1.02	0.17	0.01
6/22/95		5.20	61.54	36.72	0.51	2.98	0.04	0.56	0.35	0.03
7/11/95	7.08	4.40	45.45	15.87	0.22	38.89	0.54	0.77	0.25	0.02
7/19/95	7.29	7.75	66.13	37.02	0.52	4.01	0.06	0.57	0.09	0.01
8/14/95	7.64	14.63	20.51	3.43	0.05	6.02	0.08	0.13	0.24	0.02
10/27/95	7.23	4.20	47.62	42.80	0.60	5.00	0.07	0.67	0.55	0.04
1/30/96	6.98			97.68	1.37	7.59	0.11	1.47	0.10	0.01
3/13/96	6.96			137.30	1.92	46.91	0.66	2.58	0.21	0.02
3/28/96	7.03			75.55	1.06	7.07	0.10	1.16	0.12	0.01
4/11/96	7.15			88.54	1.24	4.11	0.06	1.30	0.22	0.02
5/9/96	7.31			69.52	0.97	3.60	0.05	1.02	0.73	0.06
6/5/96	7.10			60.53	0.85	3.88	0.05	0.90	0.095	0.01
6/11/96	7.45			57.72	0.81				0.28	0.02
MEAN=	**7.23**				**0.85**		**0.16**	**0.93**		**0.02**
SITE: SSW 5 (CSL DOWN STREAM)										
DATE	pH	TSS	%ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95								0.00		
6/19/95	7.38	4.60	56.52	24.33	0.34	5.91	0.08	0.42	0.26	0.02
6/22/95		19.20	19.79	18.42	0.26	6.59	0.09	0.35	0.46	0.04
7/11/95	6.99	2.80	57.14	13.45	0.19	7.62	0.11	0.29	3.08	0.24
7/19/95	7.06	8.12	44.62	21.89	0.31	7.95	0.11	0.42	0.20	0.02
8/14/95	7.52	7.75	38.71	2.01	0.03	8.37	0.12	0.15	0.22	0.02
10/27/95	7.02	2.20	36.36	19.29	0.27	2.66	0.04	0.31	0.35	0.03
1/30/96	6.83			103.58	1.45	5.70	0.08	1.53	0.40	0.03
2/22/96	6.74			44.28	0.62	5.42	0.08	0.70	0.63	0.05
3/13/96	6.96			73.88	1.03	5.36	0.08	1.11	0.28	0.02
4/11/96	6.73			49.18	0.69	7.96	0.11	0.80	0.21	0.02
5/7/96	6.95			31.89	0.45	5.50	0.08	0.52	0.18	0.01
6/3/96	6.98			25.46	0.36	2.24	0.03	0.39	3.07	0.24
6/5/96	6.83			27.47	0.38	8.70	0.12	0.51	0.16	0.01
6/11/96	7.19			32.51	0.46				0.58	0.05
MEAN=	**7.01**				**0.49**		**0.09**	**0.54**		**0.06**
SITE: SSW 6 (RT. 286 BROWN'S BRIDGE)										
DATE	pH	TSS	%ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.65	11.20	17.86	1.64	0.02	1.26	0.02	0.04	0.34	0.03
6/22/95		3.40	29.41	2.09	0.03	11.61	0.16	0.19	0.69	0.05
7/11/95	7.92	3.00	30.00	1.97	0.03	3.53	0.05	0.08	0.73	0.06
7/19/95	7.65	9.63	22.08	0.00	0.00	3.72	0.05	0.05	0.44	0.03
8/14/95	8.26	6.40	18.75	0.22	0.00	9.36	0.13	0.13	0.30	0.02
10/27/95	7.53	8.60	23.26	13.00	0.18	2.04	0.03	0.21	0.37	0.03
1/30/96	6.81			15.78	0.22	11.93	0.17	0.39	0.39	0.03
3/13/96	7.55			41.76	0.58	4.52	0.06	0.65	0.33	0.03
6/5/96	7.19			2.69	0.04	10.58	0.15	0.19	0.09	0.01
6/11/96	7.33			0.56	0.01	0.00	0.00	0.01	2.52	0.20
MEAN=	**7.54**	**7.04**	**23.56**		**0.11**		**0.08**	**0.19**		**0.05**

SITE: SSW 7 (CSL UP STREAM)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.19	854.00	61.36	59.51	0.83	6.39	0.09	0.92	1.02	0.08
6/22/95		117.60	61.56	39.97	0.56	10.12	0.14	0.70	0.91	0.07
7/11/95	7.44	49.33	57.43	24.82	0.35	16.70	0.23	0.58	0.98	0.08
7/19/95	7.38	310.00	58.71	42.28	0.59	10.65	0.15	0.74	0.82	0.07
8/14/95	7.26	542.00	58.86	15.67	0.22	11.15	0.16	0.38	1.15	0.09
10/27/95	6.84	9.67	58.62	43.68	0.61	0.84	0.01	0.62	0.34	0.03
1/30/96	7.08			443.32	6.21	5.58	0.08	6.28	0.78	0.06
2/22/96	7.02			91.89	1.29	7.96	0.11	1.40	1.44	0.11
3/13/96	7.18			44.72	0.63	6.00	0.08	0.71	1.04	0.08
4/11/96	6.89			32.09	0.45	3.12	0.04	0.49	0.27	0.02
5/7/96	6.97			22.64	0.32	2.66	0.04	0.35	0.21	0.02
6/3/96	6.85			12.14	0.17	6.76	0.09	0.26	0.35	0.03
6/5/96	6.82			17.36	0.24	6.65	0.09	0.34	0.37	0.03
6/11/96	7.29			31.29	0.44				0.68	0.05
MEAN=	**7.09**				**0.92**		**0.10**	**1.06**		**0.06**
SITE: SSW 8 (KDB DOWN STREAM)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.75	21.20	17.92	60.62	0.85	41.16	0.58	1.42	5.60	0.44
6/22/95		4.00	60.00	75.77	1.06	5.77	0.08	1.14	5.69	0.45
7/11/95	7.07	9.80	26.53	70.62	0.99	54.82	0.77	1.76	0.77	0.06
7/19/95	7.54	15.63	19.20	67.91	0.95	8.20	0.11	1.07	2.25	0.18
8/14/95	7.28	11.20	33.93	8.31	0.12	10.81	0.15	0.27	0.53	0.04
10/27/95	7.51	2.50	15.00	116.62	1.63	3.48	0.05	1.68	1.42	0.11
1/30/96	7.22			161.01	2.25	9.56	0.13	2.39	2.56	0.20
2/29/96	7.09			107.68	1.51	5.15	0.07	1.58	3.40	0.27
3/13/96	7.34			182.50	2.56	8.75	0.12	2.68	3.82	0.30
5/30/96	7.31			131.42	1.84	4.15	0.06	1.90	2.28	0.18
6/5/96	7.25			50.54	0.71	10.69	0.15	0.86	2.43	0.19
6/11/96	8.04			89.93	1.26				2.04	0.16
MEAN=	**7.40**				**1.31**		**0.21**	**1.52**		**0.22**
SITE: SSW 9 (KDB UP STREAM)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.92	6.20	38.71	86.26	1.21	5.00	0.07	1.28	0.62	0.05
6/22/95		36.20	38.12	80.99	1.13	7.79	0.11	1.24	5.57	0.44
7/11/95	7.30	8.00	30.00	122.73	1.72	8.06	0.11	1.83	0.85	0.07
7/19/95	7.73	17.63	36.17	66.96	0.94	27.11	0.38	1.32	2.88	0.23
8/14/95	7.35	10.20	35.29	6.25	0.09	8.51	0.12	0.21	0.53	0.04
10/27/95	7.50	1.00	37.50	111.18	1.56	3.81	0.05	1.61	1.56	0.12
1/30/96	7.17			156.67	2.19	8.00	0.11	2.31	2.83	0.22
2/29/96	7.12			166.36	2.33	6.09	0.09	2.41	3.75	0.30
3/13/96	7.33			402.40	5.63	7.33	0.10	5.74	4.65	0.37
5/30/96	7.54			104.43	1.46	4.64	0.06	1.53	2.22	0.18
6/5/96	7.20			107.75	1.51	5.65	0.08	1.59	2.78	0.22
6/11/96	8.60			104.34	1.46				2.60	0.21
MEAN=	**7.52**				**1.77**		**0.12**	**1.91**		**0.20**

SITE: SSW 10 (END OF FOREST DRIVE)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.67	1.20	33.33	125.25	1.75	4.79	0.07	1.82	1.47	0.12
6/22/95		0.80	50.00	84.70	1.19	4.85	0.07	1.25	0.58	0.05
7/11/95	7.55	1.10	72.73	108.52	1.52	6.79	0.10	1.61	1.44	0.11
7/19/95	7.40	0.80	37.50	111.88	1.57	9.67	0.14	1.70	0.29	0.02
8/14/95	7.76	0.50	80.00	215.80	3.02	2.56	0.04	3.06	0.27	0.02
10/27/95	7.56	0.50	50.00	197.81	2.77	8.46	0.12	2.89	0.23	0.02
1/30/96	7.01			80.33	1.12	26.96	0.38	1.50	0.10	0.01
3/13/96	7.24			162.92	2.28	26.32	0.37	2.65	0.47	0.04
6/5/96	7.24			105.63	1.48	11.08	0.16	1.63	0.22	0.02
6/11/96	7.40			128.56	1.80				0.41	0.03
MEAN=	**7.43**				**1.85**		**0.16**	**2.01**		**0.04**
SITE: SSW 11 (FOREST DRIVE POND)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	7.56	0.80	75.00	11.95	0.17	8.43	0.12	0.29	0.17	0.01
6/22/95		1.80	77.78	17.33	0.24	6.86	0.10	0.34	0.37	0.03
7/11/95	7.17	1.60	75.00	4.75	0.07	7.42	0.10	0.17	0.18	0.01
7/19/95	7.04	1.90	47.37	3.82	0.05	24.67	0.35	0.40	0.09	0.01
8/14/95	7.78	4.40	77.27	3.34	0.05	8.85	0.12	0.17	0.03	0.00
10/27/95	7.00	1.13	77.78	10.16	0.14	9.24	0.13	0.27	0.21	0.02
1/30/96	6.86			112.88	1.58	8.71	0.12	1.70	0.00	0.00
3/13/96	7.10			105.28	1.47	6.79	0.10	1.57	0.16	0.01
6/5/96	7.17			53.47	0.75	3.81	0.05	0.80	0.06	0.00
6/11/96	7.18			45.21	0.63				0.10	0.01
MEAN=	**7.21**				**0.52**		**0.13**	**0.63**		**0.01**
SITE: SSW 12 (RT. 1 CULVERT)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
6/8/95										
6/19/95	9.15	1.40	71.43	92.07	1.29	4.75	0.07	1.36	0.32	0.03
6/22/95		1.00	80.00	89.80	1.26	2.14	0.03	1.29	0.35	0.03
7/11/95	7.37	1.20	83.33	46.98	0.66	15.98	0.22	0.88	2.21	0.17
7/19/95	7.37	1.10	63.64	39.92	0.56	19.54	0.27	0.83	0.07	0.01
8/14/95	9.74	1.30	46.15	96.87	1.36	3.17	0.04	1.40	0.07	0.01
10/27/95	7.18	0.87	57.14	39.17	0.55	5.18	0.07	0.62	0.18	0.01
1/30/96	6.88			123.46	1.73	7.62	0.11	1.84	0.00	0.00
3/13/96	7.17			100.96	1.41	18.45	0.26	1.67	0.201	0.02
6/5/96	7.11			59.51	0.83	3.88	0.05	0.89	0.065	0.01
6/11/96	9.11			78.4	1.10				0.22	0.02
MEAN=	**7.90**				**1.07**		**0.13**	**1.20**		**0.03**
SITE: SSW 13 (PUBLIC DOCK/BEACH)										
DATE	pH	TSS	%-ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
8/14/95	8.22	2.90	24.14	1.60	0.02	1.37	0.02	0.04	0.29	0.02
8/23/95		3.00	30.00	0.60	0.01	3.03	0.04	0.05	0.29	0.02
1/30/96	7.92			10.23	0.14	3.07	0.04	0.19	0.53	0.04
3/13/96	7.97			11.47	0.16	1.40	0.02	0.18	0.54	0.04
6/5/96	7.74			2.61	0.04	58.89	0.82	0.86	0.34	0.03
6/11/96	7.84			2.31	0.03	0.00	0.00	0.03	0.70	0.06
MEAN=	**7.94**				**0.07**		**0.16**	**0.23**		**0.04**

SITE: SSW 14 (END OF RIVER STREET)										
DATE	pH	TSS	%ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
8/14/95	8.23	7.60	17.11	0.59	0.01	3.66	0.05	0.06	0.22	0.02
8/23/95		4.00	27.50	2.02	0.03	2.17	0.03	0.06	0.34	0.03
1/30/96	7.65			15.30	0.21				0.28	0.02
3/13/96	7.89			6.85	0.10	4.96	0.07	0.17	0.41	0.03
6/5/96	7.53			3.19	0.04	22.18	0.31	0.36	0.13	0.01
6/11/96	7.69			1.62	0.02	0.76	0.01	0.03	0.30	0.02
MEAN=	**7.80**				**0.07**		**0.09**	**0.13**		**0.02**
SITE: SSW 15 (HAMPTON/SEABROOK BRIDGE)										
DATE	pH	TSS	%ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
8/14/95	8.20	15.30	14.38	3.34	0.05	8.32	0.12	0.16	0.27	0.02
8/23/95		2.90	31.03	0.52	0.01	3.26	0.05	0.05	0.22	0.02
1/30/96	7.64			12.13	0.17				0.36	0.03
3/13/96	8.05			7.54	0.11	3.64	0.05	0.16	0.40	0.03
6/5/96	7.66			13.85	0.19	0.85	0.01	0.21	0.14	0.01
6/11/96	7.85			5.53	0.08	5.14	0.07	0.15	0.29	0.02
MEAN=	**7.88**				**0.10**		**0.06**	**0.15**		**0.02**
SITE: SSW 16 (HAMPTON UNSEWERED/MOUTH OF HARBOR)										
DATE	pH	TSS	%ORG	NO3	**NO3**	NH4	**NH4**	**DIN**	PO4	**PO4**
8/23/95		6.90	11.59	6.13	0.09	13.86	0.19	0.28	1.12	0.09
1/30/96	7.90			12.68	0.18			0.18		
3/13/96	8.13			2.35	0.03	1.46	0.02	0.05	0.53	0.04
6/5/96	8.04			1.52	0.02	9.98	0.14	0.16	0.63	0.05
6/11/96	8.39			8.12	0.11	4.16	0.06	0.17	0.29	0.02
MEAN=	**8.12**				**0.09**		**0.10**	**0.17**		**0.05**

		TABLE 12				
SEABROOK SURFACE WATER: MICROBIOLOGICAL DATABASE						
BACTERIAL COUNTS: CFU/100mls						
SALINITY: ppt						
TEMP: degrees C						
SITE: SSW 1 (REH DOWN STREAM)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	29.70	16.00	45.50	44.50	44.50	8.00
6/19/95	27.00	29.50	61.50	61.50	103.50	18.25
6/22/95	29.00	25.00	47.00	43.00	27.00	4.00
7/11/95	30.00	16.50	20.00	20.00	114.00	4.75
7/19/95	30.00		34.00	22.00	35.00	4.25
8/14/95	31.00	22.00	13.50	13.50	40.25	1.75
10/5/95	24.00		105.00	20.00	33.00	4.00
1/30/96	16.00	4.30	3.00	1.50	6.00	0.24
3/13/96	26.00	6.20	22.50	18.00	1.50	5.00
5/23/96	22.00	21.20	132.00	129.00	7.33	0.24
6/5/96	17.00	17.30	72.50	62.50	132.50	2.00
6/11/96	26.00	28.00	10.00	10.00	10.00	0.24
MEAN=	**25.64**	GEOMEAN=	**31.10**	**23.64**	**24.93**	**2.18**
SITE: SSW 2 (REH UP STREAM)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	29.70	16.00	34.00	34.00	48.50	6.50
6/19/95	28.00	23.40	390.00	370.00	247.50	2.50
6/22/95	28.00	21.00	305.00	290.00	38.75	9.50
7/11/95	28.00	15.90	35.00	35.00	92.00	10.75
7/19/95	30.00		24.00	12.00	31.00	6.50
8/14/95	31.00	22.00	30.00	30.00	66.25	1.75
10/5/95	24.00		35.00	20.00	26.00	3.75
10/27/95	26.20	10.80	25.00	24.00	6.50	0.24
1/30/96	20.00	4.30	4.00	3.00	5.25	9.50
3/13/96	27.00	4.00	0.24	0.24	0.25	2.50
5/23/96	21.00	17.50	41.50	36.00	15.00	7.50
6/5/96	25.00	16.50	39.50	36.00	46.00	4.50
6/11/96	26.00	24.00	1.00	1.00	2.00	0.25
MEAN=	**26.45**	GEOMEAN=	**20.85**	**17.98**	**18.36**	**3.18**
SITE: SSW3 (CAUSEWAY STREET BRIDGE)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	1.00	18.00	535.00	465.00	206.50	25.00
6/19/95	0.00	23.80	800.00	490.00	43.75	17.50
6/22/95	5.00	21.00	605.00	340.00	36.00	6.00
7/11/95	15.00	19.00	2700.00	1800.00	230.00	7.50
7/19/95	3.00		1100.00	650.00	252.50	17.00
8/14/95	30.00	23.00	170.00	170.00	33.00	0.25
10/27/95	2.50	11.20	480.00	415.00	69.00	7.00
1/30/96	18.00	2.30	85.00	55.00	41.00	85.00
3/13/96	0.00	2.20	26.00	19.00	2.00	5.00
3/28/96	0.00	5.70	15.00	14.00	2.50	80.00
4/11/96	0.00	6.00	53.00	32.00	50.00	57.00
5/7/96	0.00	11.10	140.00	112.00	43.00	81.00
5/9/96	0.00	14.00	117.00	105.00	32.00	185.00
6/5/96	0.00	18.00	870.00	750.00	85.00	24.75
6/11/96	0.00	25.00	210.00	200.00	109.00	6.00
MEAN=	**4.97**	GEOMEAN=	**233.29**	**177.08**	**44.67**	**16.86**

SITE: SSW 4 (TIDAL CREEK BEHIND HUBERT)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	17.50	460.00	397.50	168.00	2.50
6/19/95	0.00	28.10	830.00	407.50	151.20	6.75
6/22/95	2.00	20.50	670.00	340.00	101.25	8.00
7/11/95	8.00	19.20	4400.00	2200.00	170.00	18.00
7/19/95	0.00		1100.00	600.00	220.00	129.00
8/14/95	29.00	23.50	240.00	240.00	218.00	0.75
10/27/95	0.00	11.30	400.00	325.00	102.50	11.50
1/30/96	0.00	1.90	73.00	38.00	107.50	80.00
3/13/96	0.00	2.50	50.00	49.00	1.00	11.00
3/28/96	0.00	8.00	24.00	20.00	2.00	66.00
4/11/96	0.00		39.00	32.00	32.00	61.00
5/9/96	0.00	14.00	135.00	120.00	48.00	168.00
6/5/96	0.00	18.10	740.00	670.00	123.25	18.25
6/11/96	0.00	26.00	200.00	195.00	25.00	35.00
MEAN=	**2.79**	**GEOMEAN=**	**264.29**	**193.87**	**54.77**	**19.34**
SITE: SSW 5 (CSL DOWN STREAM)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	18.00	134.50	126.50	60.00	33.50
6/19/95	0.00	25.00	545.00	460.00	144.00	83.50
6/22/95	0.00	23.70	795.00	785.00	95.00	46.00
7/11/95	6.00	18.50	3100.00	2300.00	660.00	37.50
7/19/95	2.00		950.00	850.00	950.00	20.00
8/14/95	25.00	24.00	300.00	300.00	208.00	0.24
10/27/95	0.80	11.00	270.00	210.00	5.00	1.50
1/30/96	0.00		175.00	90.00	18.00	26.00
3/13/96	0.00	2.50	70.00	42.50	8.00	28.50
4/11/96	0.00	7.20	50.00	50.00	1.00	35.00
5/7/96	0.00	13.80	35.00	23.00	26.00	12.00
6/3/96	0.00	16.70	205.00	195.00	40.50	16.00
6/5/96	0.00	17.00	337.50	327.50	49.50	10.00
6/11/96	0.00	23.00	2035.00	2015.00	900.00	
MEAN=	**2.41**	**GEOMEAN=**	**297.21**	**247.22**	**56.77**	**14.86**
SITE: SSW 6 (RT. 286 BROWN'S BRIDGE)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	26.00	14.00	26.50	24.00	15.00	4.00
6/19/95	28.00	21.00	62.00	42.50	13.50	2.25
6/22/95	28.00	18.90	9.00	9.00	9.25	3.75
7/11/95	29.00	13.00	75.00	70.00	19.75	2.25
7/19/95	26.00		67.50	57.50	32.75	1.25
8/14/95	31.00	18.00	6.00	6.00	11.75	1.75
10/27/95	23.90	10.80	19.25	18.00	41.00	2.25
1/30/96	2.00	0.10	135.00	91.50	125.00	39.50
3/13/96	22.00	2.00	5.00	2.50	0.24	8.00
6/5/96	24.00	17.20	63.00	61.00	63.25	1.25
6/11/96	21.50	21.40	25.00	25.00	10.00	1.75
MEAN=	**23.76**	**GEOMEAN=**	**28.26**	**23.81**	**15.34**	**3.10**

SITE: SSW 7 (CSL UP STREAM)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	15.50	255.00	230.00	136.50	44.50
6/19/95	0.00	18.50	400.00	340.00	430.00	410.00
6/22/95	0.00	14.50	380.00	370.00	468.75	140.00
7/11/95	0.00	16.00	4500.00	4200.00	4600.00	400.00
7/19/95	0.00		9700.00	2600.00	10500.00	142.50
8/14/95	1.00	19.90	7375.00	3875.00	1070.00	800.00
10/27/95	0.20	11.20	125.00	75.00	5.00	55.00
1/30/96	0.00		400.00	225.00	24.00	42.00
2/22/96	0.00		3480.00	970.00	237.00	383.00
3/13/96	0.00	2.50	230.00	215.00	8.00	33.00
4/11/96	0.00	6.50	310.00	155.00	6.00	39.00
5/7/96	0.00	11.50	32.00	24.00	13.50	3.50
6/3/96	0.00	13.80	104.00	82.00	42.50	53.50
6/5/96	0.00	14.50	445.00	445.00	89.50	16.00
6/11/96	0.00	22.90	3615.00	2872.00	1175.00	
MEAN=	**0.08**	**GEOMEAN=**	**623.11**	**412.11**	**137.38**	**79.42**
SITE: SSW 8 (KDB DOWN STREAM)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	20.50	365.00	330.00	233.00	8.00
6/19/95	0.00	27.30	120.00	110.00	496.25	7.75
6/22/95	1.00	26.00	10.00	10.00	3040.00	16.00
7/11/95	11.00	18.50	1600.00	1600.00	2050.00	50.00
7/19/95	2.00		1750.00	1750.00	850.00	70.00
8/14/95	24.00	25.52	375.00	375.00	800.00	5.00
10/19/95		14.50	106.00	50.00	540.00	5.00
10/27/95	2.00	11.20	125.00	120.00	190.00	3.25
1/30/96	0.00		8	5.75	26.5	14.5
2/29/96	0.00		1.5	1.5	5.5	2.5
3/13/96	0.00	4.50	0.24	0.24	3.00	7.50
5/30/96	0.00		279.00	272.00	53.75	7.50
6/5/96	2.00		580.00	580.00	137.25	4.50
6/11/96	0.00	27.00	60.00	60.00	478.00	13.75
MEAN=	**3.23**	**GEOMEAN=**	**74.76**	**67.96**	**189.59**	**9.29**
SITE: SSW 9 (KDB UP STREAM)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	20.50	285.00	240.00	197.50	6.00
6/19/95	0.00	26.80	205.00	155.00	605.00	12.75
6/22/95	0.00	25.30			470.00	4.75
7/11/95	2.00	18.30	4300.00	4100.00	19.85	140.00
7/19/95	0.00		5250.00	5125.00	1250.00	100.00
8/14/95	26.00	26.50	95.00	95.00	1795.00	0.50
10/19/95		14.90	103.50	70.50	460.00	1.50
10/27/95	2.00	11.20	132.50	125.00	120.00	1.25
1/30/96	0.00		8.00	8.00	26.50	13.00
2/29/96	0.00		3.00	2.50	2.00	2.00
3/13/96	0.00	5.80	3.50	1.00	9.00	15.50
5/30/96	0.00		239.00	233.00	272.00	8.50
6/5/96	0.00		460.00	455.00	129.00	5.75
6/11/96	0.00	26.00	20.00	20.00	557.00	10.25
MEAN=	**2.31**	**GEOMEAN=**	**109.29**	**90.61**	**141.48**	**7.18**

SITE: SSW 10 (END OF FOREST DRIVE)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/19/95	0.00	16.50	287.50	147.50	103.75	8.00
6/22/95	0.00	15.00	95.00	72.50	77.00	2.00
7/11/95	0.00	15.50	800.00	746.60	462.00	15.75
7/19/95	0.00		3250.00	700.00	625.00	24.00
8/14/95	1.00	19.00	1975.00	1545.00	312.00	0.75
10/27/95	0.20	10.90	90.00	65.00	25.00	4.25
1/30/96	0.00		95.00	0.24	13.00	8.00
3/13/96	0.00	5.00	32.50	25.00	29.50	7.75
6/5/96	0.00		444.00	376.00	19.75	4.00
6/11/96	0.00	18.00	125.00	90.00	40.50	0.24
MEAN=	**0.12**	**GEOMEAN=**	**271.33**	**101.32**	**74.85**	**4.04**
SITE: SSW 11 (FOREST DRIVE POND)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	19.50	184.50	176.50	87.00	14.50
6/19/95	0.00	25.40	66.25	52.50	35.00	1.75
6/22/95	0.00	22.50	42.00	42.00	4.00	1.50
7/11/95	0.00	22.00	16.00	16.00	39.00	3.25
7/19/95	0.00		60.00	60.00	46.25	4.25
8/14/95	1.00	26.00	70.00	65.00	22.75	3.00
10/27/95	0.40	10.00	17.50	17.50	10.50	1.75
1/30/96	0.00		10.00	8.50	6.75	8.00
3/13/96	0.00	0.50	2.50	1.00	5.00	4.75
6/5/96	0.00		165.00	160.00	57.00	4.00
6/11/96	0.00	22.00	60.00	60.00	6.50	0.24
MEAN=	**0.13**	**GEOMEAN=**	**36.42**	**31.89**	**18.03**	**2.85**
SITE: SSW 12 (RT. 1 CULVERT))						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
6/8/95	0.00	23.00	255.00	232.50	198.00	29.00
6/19/95	0.00	28.10	252.50	202.50	46.25	7.75
6/22/95	0.00	25.90	52.50	50.00	19.00	13.50
7/11/95	0.00	19.00	120.00	120.00	195.50	13.25
7/19/95	0.00		160.00	90.00	130.00	1.50
8/14/95	0.00	27.50	45.00	30.00	11.00	6.75
10/27/95	0.60	11.00	32.00	31.00	10.50	12.75
1/30/96	0.00		28.25	21.00		
3/13/96	0.00	2.00	2.00	2.00	2.40	20.00
6/5/96	0.00		300.00	285.00	44.75	5.50
6/11/96	0.00	25.10	155.00	155.00	20.00	5.50
MEAN=	**0.05**	**GEOMEAN=**	**71.39**	**61.04**	**31.92**	**8.91**
SITE: SSW 13/HH18 (PUBLIC DOCK/BEACH)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
8/14/95	30.00	17.00	12.50	10.25	16.00	4.75
8/23/95	30.00		19.00	17.25	10.50	8.25
10/27/95	27.20	11.00	30.00	23.00		
10/31/95	28.00		30.00	27.00		
1/30/96	23.00	2.40	25.00	17.75	10.25	66.00
3/13/96	23.00	6.00	340.00	340.00	3.00	15.00
6/5/96	22.00	14.10	57.00	48.00	24.50	6.50
6/11/96		16.00			6.50	40.00
MEAN=	**26.17**	**GEOMEAN=**	**37.46**	**31.65**	**9.68**	**14.70**

SITE: SSW 14/HH2B (END OF RIVER STREET)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
8/14/95	31.00	19.00	35.00	35.00	10.25	8.50
8/23/95	30.00		14.00	12.00	1.25	1.75
10/27/95	27.20	10.00	69.50	55.50		
10/31/95	25.00		44.50	44.00		
1/30/96	12.00	0.40	50.00	37.50	107.50	105.00
3/13/96	26.00	4.50	2.00	2.00	0.90	5.00
6/5/96	26.00	15.30	51.75	47.75	34.50	2.50
6/11/96		19.50	5.00	5.00	2.25	2.00
MEAN=	**25.31**	**GEOMEAN=**	**21.09**	**19.19**	**6.77**	**5.82**
SITE: SSW 15/HH17 (HAMPTON/SEABROOK BRIDGE)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
8/14/95	30.00	17.00	720.00	720.00	14.25	0.50
8/23/95	30.00		2.75	2.50	0.75	2.25
10/27/95	27.10	10.10	46.50	38.50		
10/31/95	31.00		25.50	23.50		
1/30/96	16.00	1.60	30.00	25.00	64.50	85.00
3/13/96	25.00	3.70	2.00	2.00	0.40	2.50
6/5/96	25	15	41.75	37.5	19.75	5.00
6/11/96		18	6	6	1.25	4.00
MEAN=	**26.30**	**GEOMEAN=**	**20.82**	**19.18**	**4.35**	**4.10**
SITE: SSW 16 (HAMPTON UNSEWERED/MOUTH OF HARBOR)						
DATE	SALINITY	TEMP.	FC	E. c	Ent	C. perf.
8/23/95	30.00		50.00	50.00	15.00	2.00
1/30/96	16	5.4	7	7	2	1
3/13/96	27	9.2	0.24	0.24	0.24	0.24
6/5/96	24		1.5	1.5	2	0.24
6/11/96		27	0.24	0.24	3.75	0.25
MEAN=	**24.25**	**GEOMEAN=**	**1.98**	**1.98**	**2.22**	**0.49**

TABLE 13

MICROBIOLOGICAL ANALYSIS OF SOIL CORES TAKEN BENEATH EDA's

SITE: WRH (8/7/95)

DEPTH (bgs)		
31.5"	fecal coliforms	0
	E. coli	0
	C. perfringens	9000
46"	fecal coliforms	0
	E. coli	0
	C. perfringens	5000
55"	fecal coliforms	0
	E. coli	0
	C. perfringens	17000

SITE: KDBS (10/19/95)

DEPTH (bgs)		
29"	fecal coliforms	800
	E. coli	800
	C. perfringens	13000
42"	fecal coliforms	0
	E. coli	0
	C. perfringens	13000
55"	fecal coliforms	20
	E. coli	20
	C. perfringens	17000

SITE: FDC (8/8/95)

DEPTH (bgs)		
26"	fecal coliforms	0
	E. coli	0
	C. perfringens	1100
38"	fecal coliforms	0
	E. coli	0
	C. perfringens	7000
47"	fecal coliforms	0
	E. coli	0
	C. perfringens	0
51.5"	fecal coliforms	0
	E. coli	0
	C. perfringens	6000

SITE: KDBS (10/19/95)

DEPTH (bgs)		
33"	fecal coliforms	0
	E. coli	0
	C. perfringens	50000
44"	fecal coliforms	0
	E. coli	0
	C. perfringens	9000
59"	fecal coliforms	20
	E. coli	20
	C. perfringens	2200

SITE: CSL (8/7/95)

DEPTH (bgs)		
35"	fecal coliforms	400
	E. coli	400
	C. perfringens	7000
43"	fecal coliforms	0
	E. coli	0
	C. perfringens	5

			TABLE 14			
Bacterial Concentrations and Watertable Depth below EDA at WRH, CSL, KDBM, and KDBS						
CSL4	<36	2/23/95	1	1	0.49	0.24
CSL4	<36	3/30/95	0.24	0.24	0.5	0.5
CSL4	<36	4/25/95	0.24	0.24	0.24	22
CSL4	<36	5/11/95	0.25	0.25	0.24	0.24
CSL4	<36	6/5/95	0.24	0.24	0.24	2
CSL4	<36	6/26/95	53.25	48.5	0.24	2.25
CSL4	<36	10/26/95	0.24	0.24	0.24	0.24
CSL4	<36	2/22/96	10	6	49.5	7.75
CSL4	<36	4/11/96	0.25	0.25	0.24	0.25
CSL4	<36	5/7/96	0.25	0.25	0.5	0.24
CSL4	<36	6/3/96	0.24	0.24	0.25	0.5
WRH1	<36	11/18/95	60	22		
WRH1	<36	2/8/96	58			
WRH1	<36	3/28/96	432	424		
WRH1	<36	5/9/96	40	20	400	***4.9***
WRH2	<36	4/6/95	67.25	51	23	0.49
WRH2	<36	11/18/95	6.5			
WRH2	<36	2/8/96	0.24	0.24	0.25	3.5
WRH2	<36	3/28/96	0.24	0.24	0.24	3
WRH2	<36	5/9/96	0.24	0.24	0.24	1
WRH5	<36	3/2/95	35.5	29.25	12	0.24
WRH5	<36	4/6/95	16.25	6.25	2.75	0.24
WRH5	<36	4/25/95	2.75	2.25	3	0.24
WRH5	<36	11/18/95	2130	500	8100	0.24
WRH5	<36	2/8/96	400	250	64	***1.9***
WRH5	<36	3/28/96	300	280	232	***1.9***
WRH5	<36	5/9/96	120	30	19	0.5
KDBM3	<36	2/29/96	1.5	0.24	0.49	0.5
KDBM3	≥36but<48	3/7/95	75	71.5	0.24	0.24
KDBM3	≥36but<48	3/23/95	1.5	1.5	0.24	0.25
KDBM3	≥36but<48	4/4/95	0.24	0.24	0.24	0.5
KDBM3	≥36but<48	5/2/95	0.24	0.24	0.24	0.75
KDBM3	≥36but<48	5/22/95	0.24	0.24	0.24	0.24
KDBM3	≥36but<48	4/4/96	0.49	0.49		51
KDBM3	≥36but<48	5/30/96	0.24	0.24	0.24	3.25
KDBS4	≥36but<48	3/7/95	0.24	0.24	0.24	0.24
KDBS4	≥36but<48	3/23/95	0.24	0.24	0.24	0.24
KDBS4	≥36but<48	2/29/96	0.49	0.49		
KDBS4	≥36but<48	4/4/96	0.49	0.49		
KDBS4	≥48	4/4/95	0.24	0.24	0.24	0.24
KDBS4	≥48	5/30/96	0.49	0.49	0.09	0.49
		<36	5.28	3.36	2.52	0.83
	GEOMEAN	≥36but<48	0.58	0.58	0.24	0.72
		≥48	0.34	0.34	0.15	0.34
		p-value	0.049	N/S	N/S	N/S

Figure 1. Seabrook and Hampton Harbor with study sites circled, labeled with 2-3 CAPITOL LETTERS.

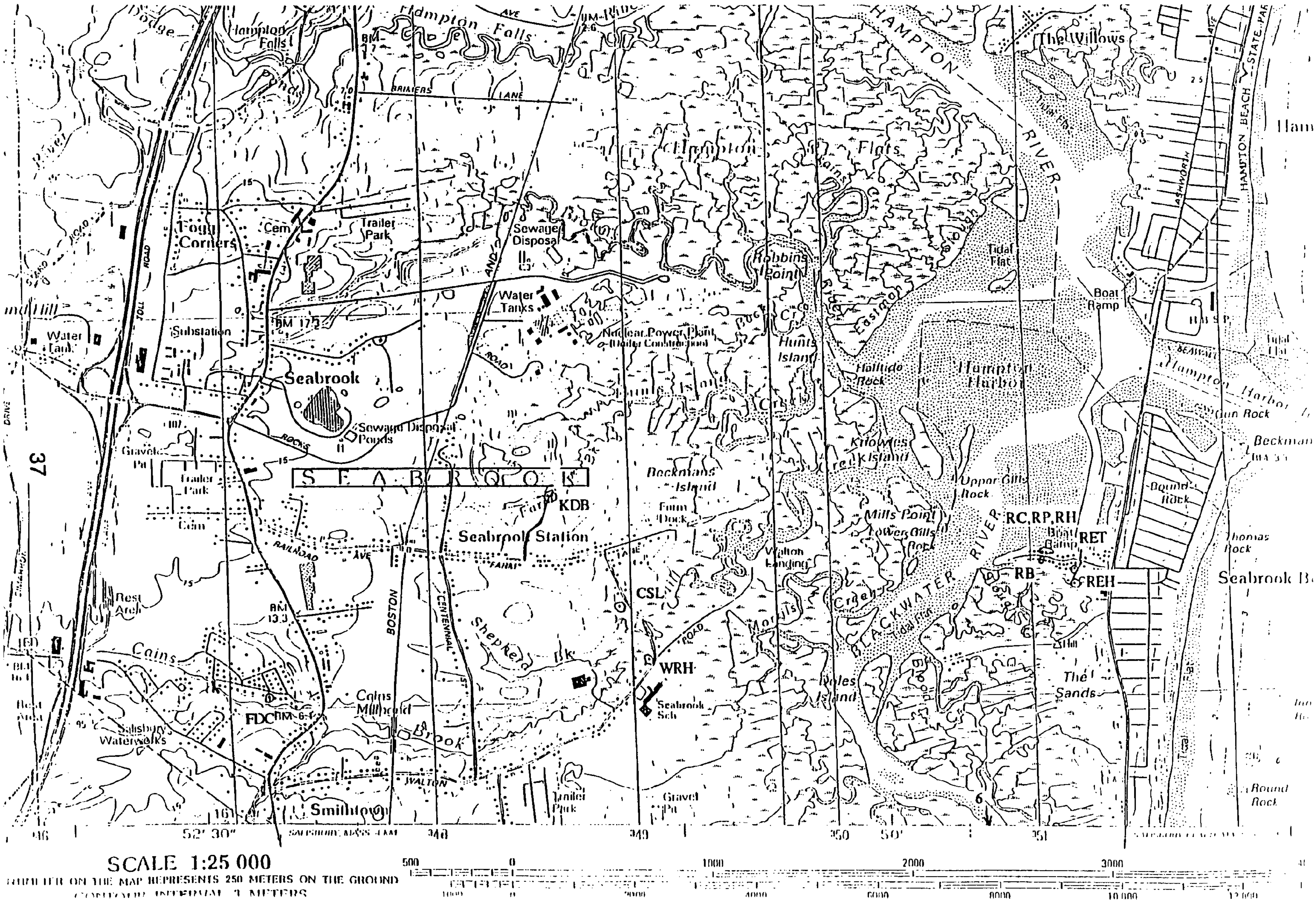
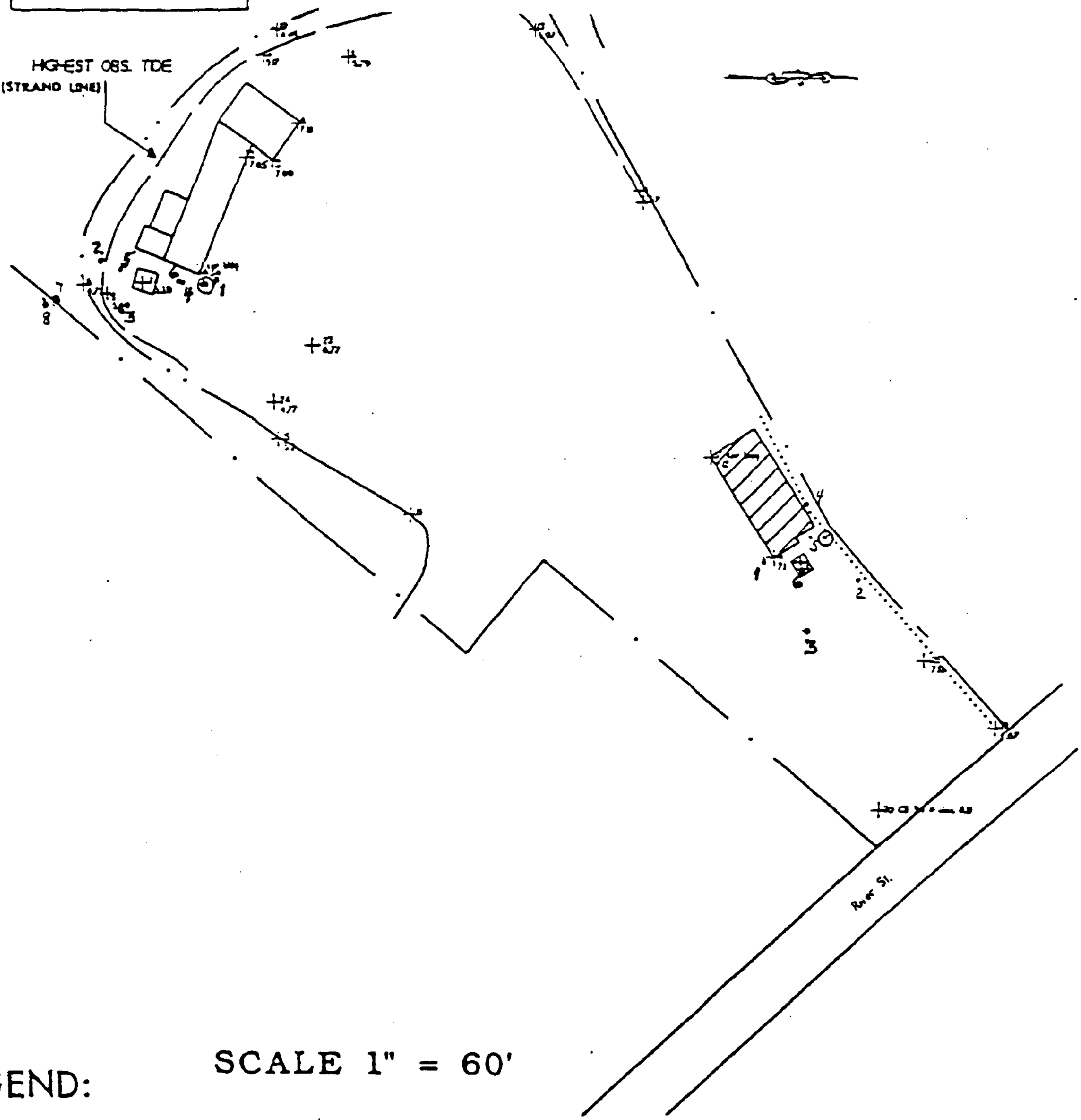


Figure 2. Location of groundwater wells at site REH.



LEGEND:

PROPERTY BOUNDARY (APPROX.)

STRUCTURE

EFFLUENT DISPOSAL AREA (EDA)

WETLAND EDGE

NOTE: BOUNDARIES AND OTHER DETAILS DEPICTED ON THE PLAN ARE ONLY APPROXIMATE AND CARE SHOULD BE EXERCIZED IN THEIR USE!

OWNER: EASTMAN, C.
MAP# 23 LOT# 48-1
ADDRESS: 48A RIVER ST.
OCTOBER, 1994

ELKIND ENVIRONMENTAL ASSOCIATES, INC.
EEA
6 BAYMEADOW DR.
NASHUA, NEW HAMPSHIRE 03063
(603) 889-4357
ENGINEERING PERMITTING CONSULTING

Figure 3. Location of groundwater wells at site RP.

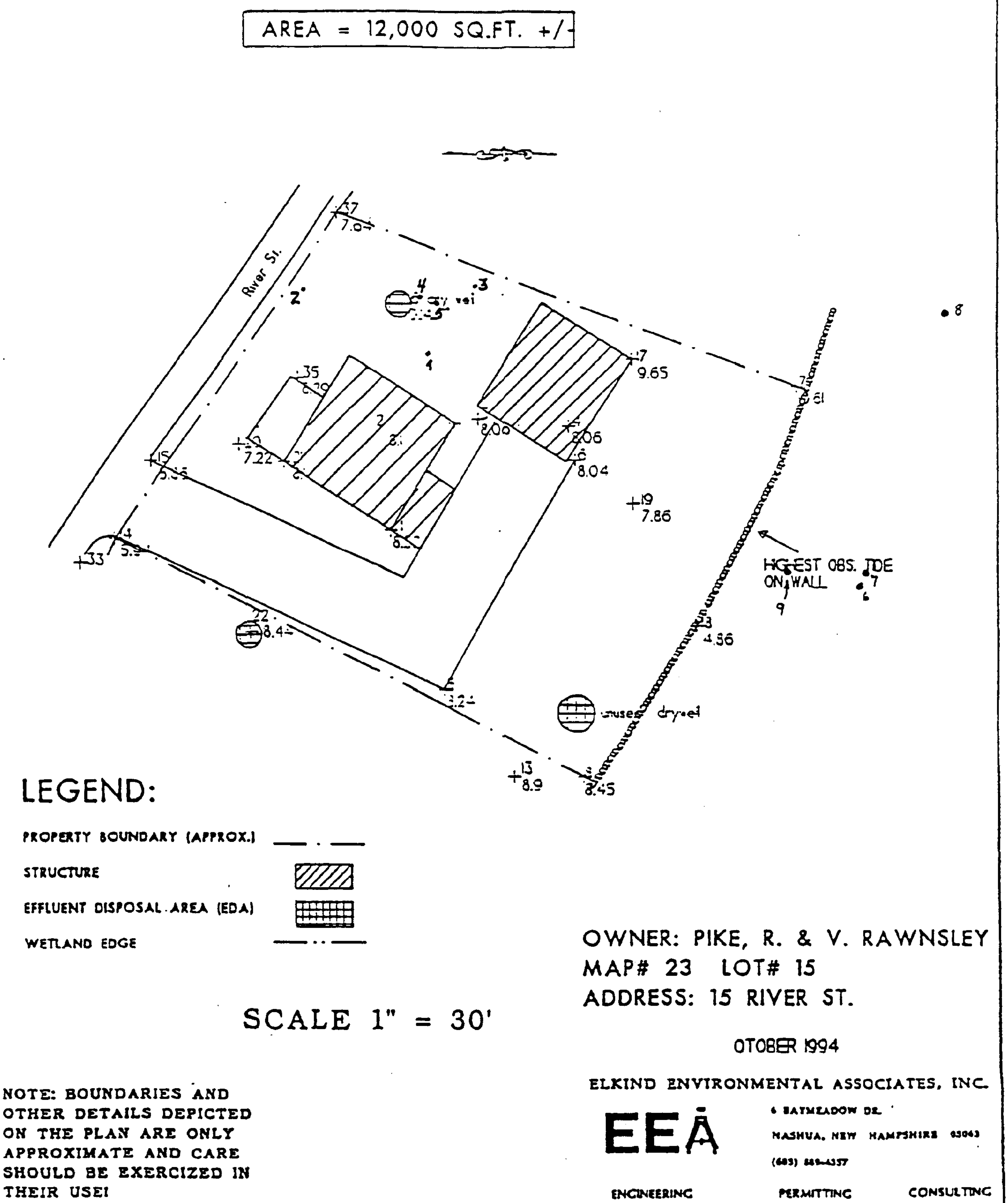


Figure 4. Location of groundwater wells at site WRH.

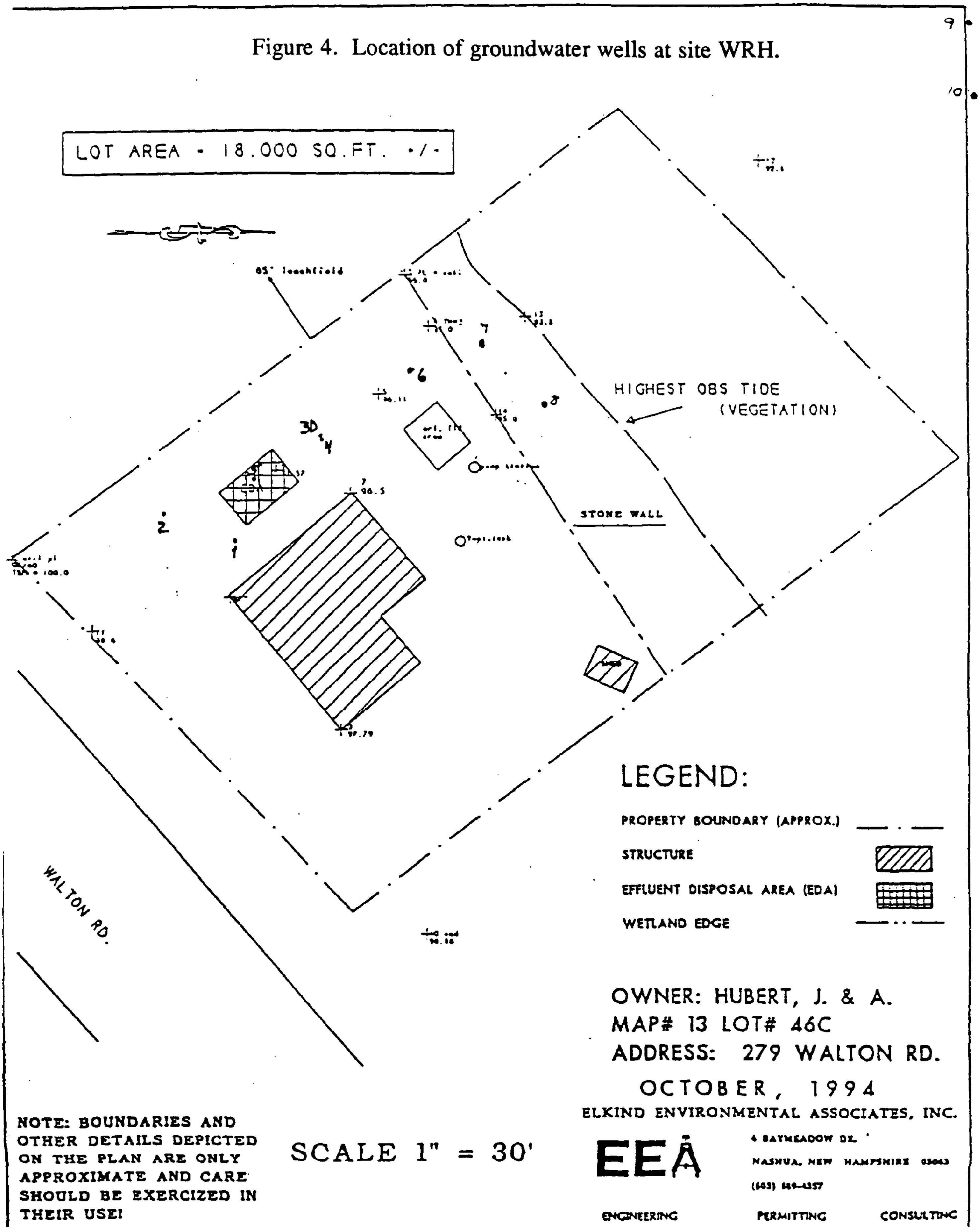
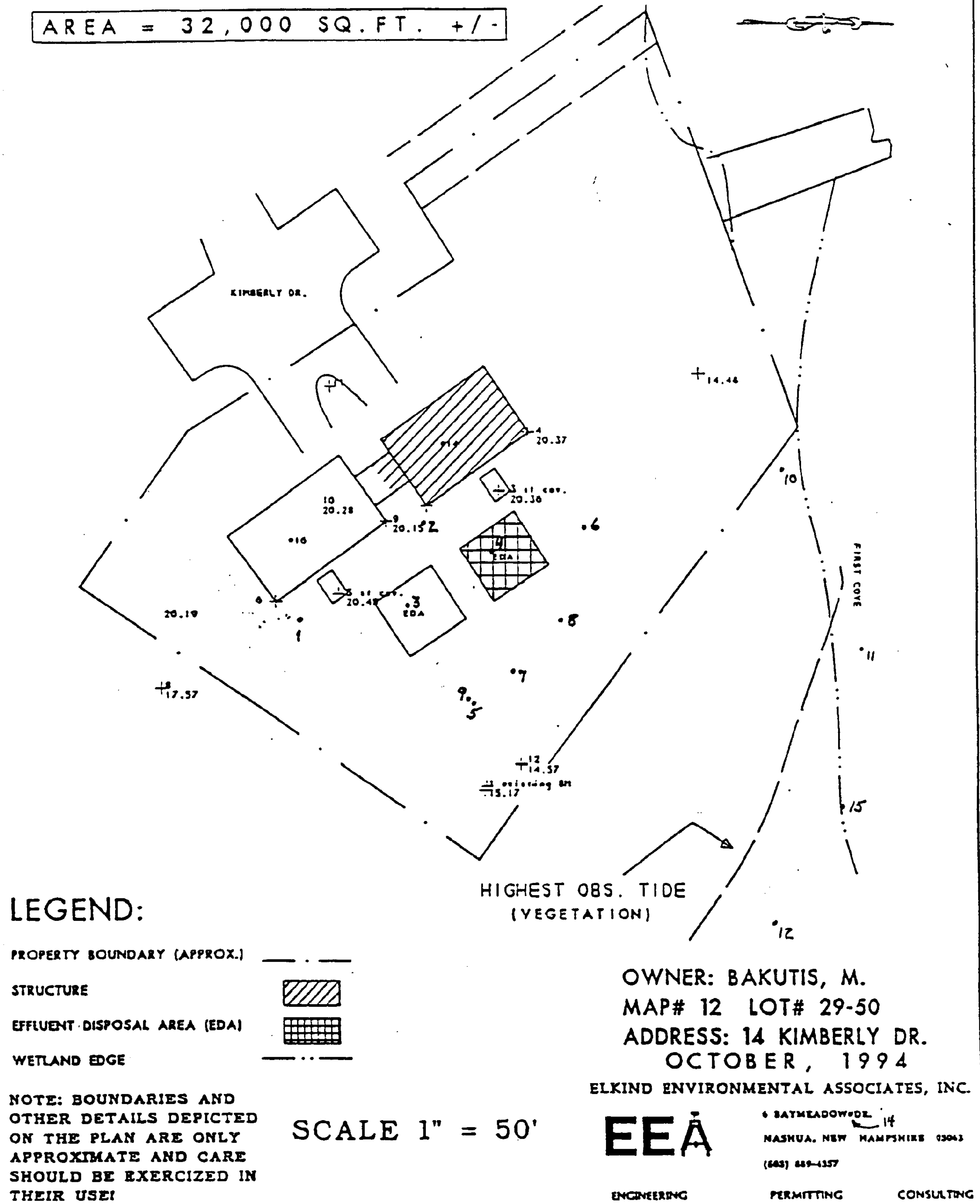


Figure 5. Location of groundwater wells at site KDB.



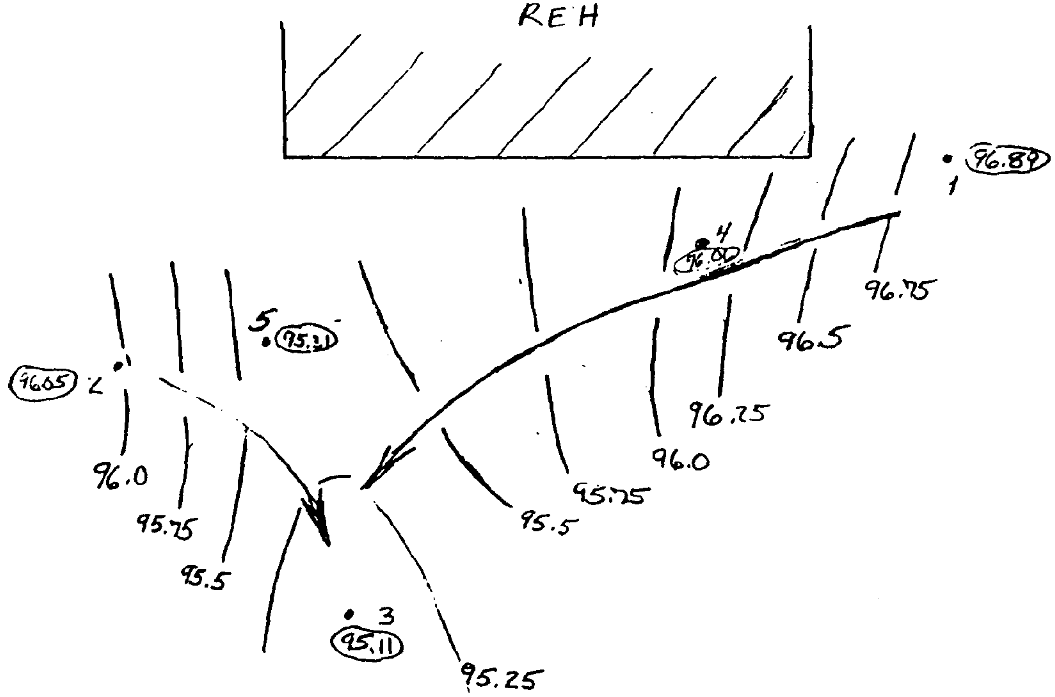


Figure 6. Groundwater flow directions at site REH during low tide: 3/13/95.

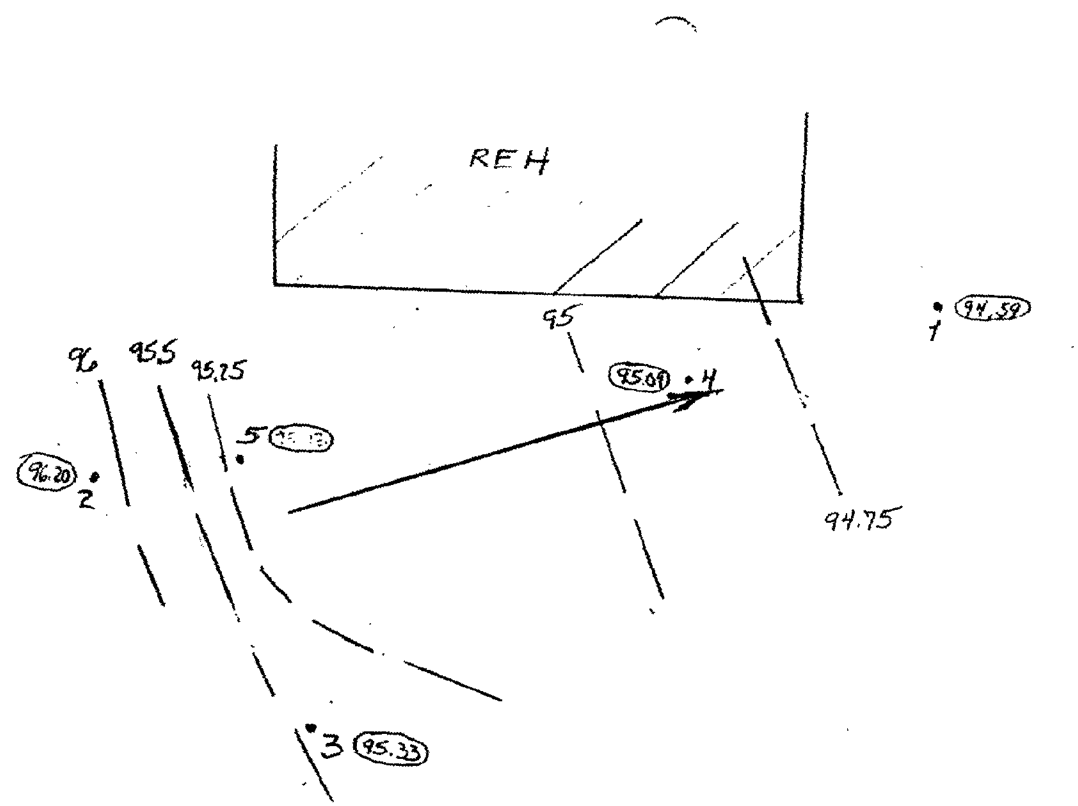
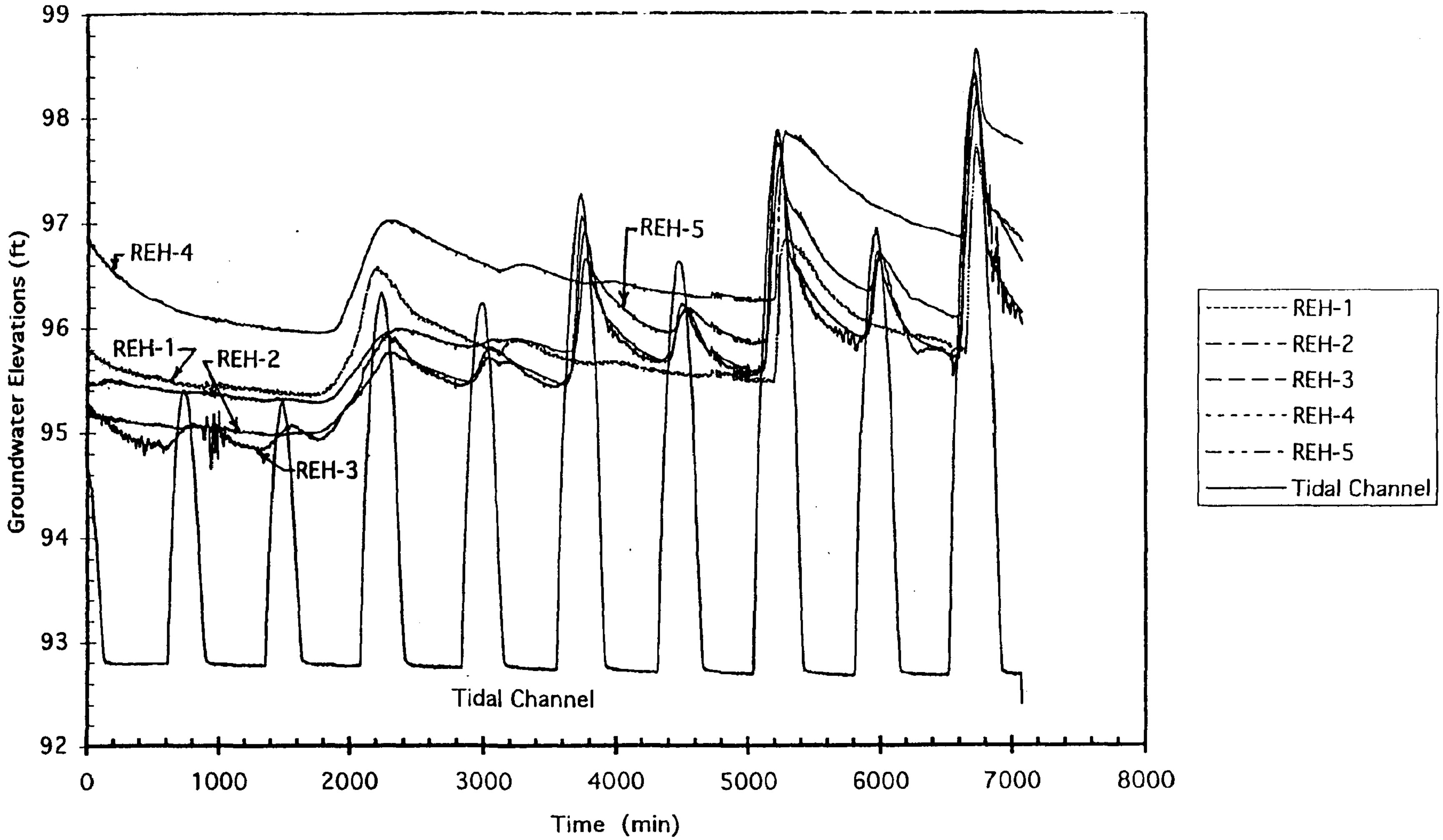


Figure 7. Groundwater flow direction at site REH during high tide: 5/31/95.

Figure 8. Long-term groundwater monitoring in wells at site REH.



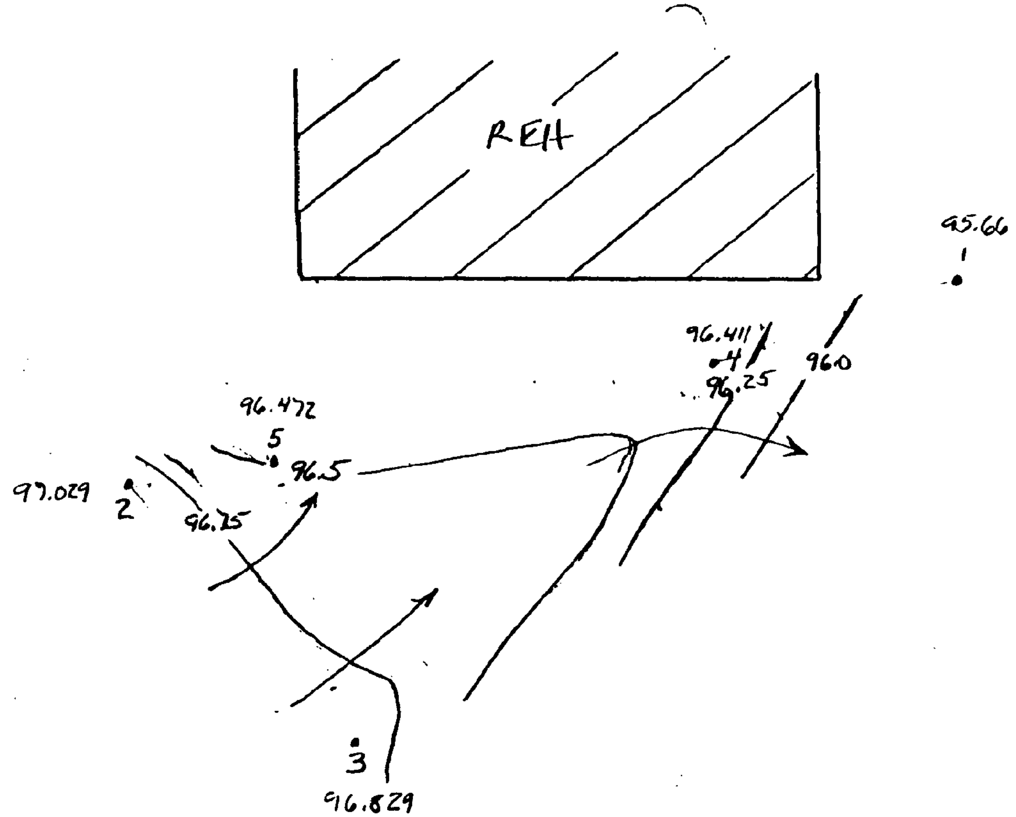


Figure 9. Groundwater flow directions at site REH during high tide, based on pressure transducer data: 11/20/95.

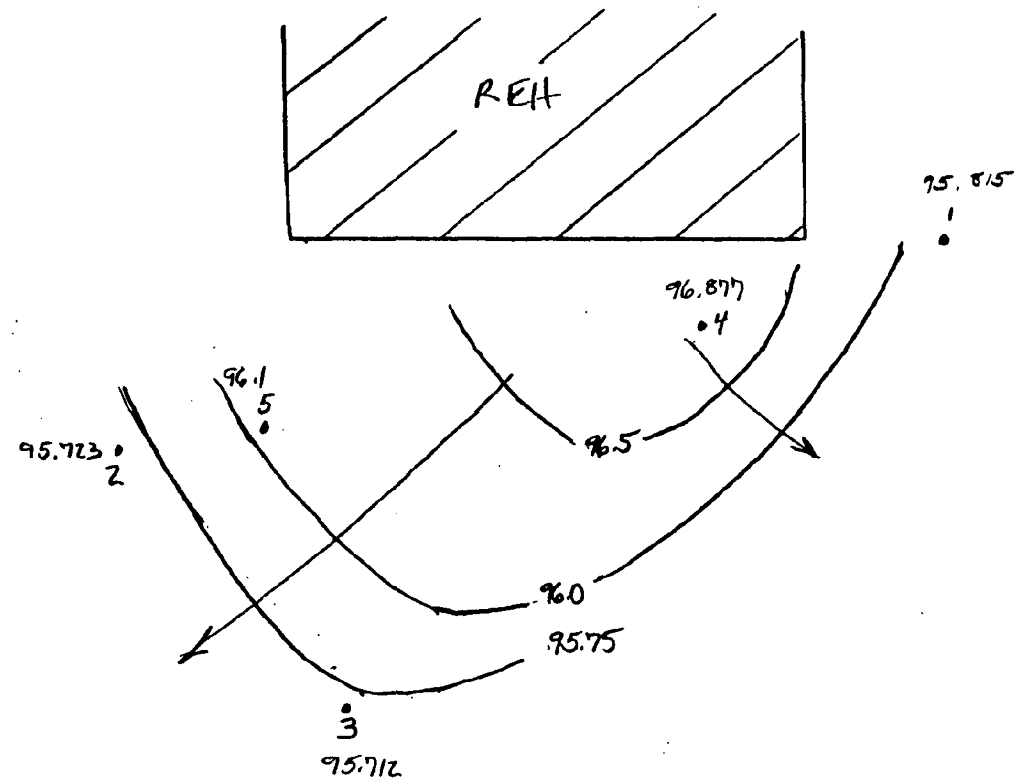


Figure 10. Groundwater flow directions at site REH during low tide, based on pressure transducer data: 11/22/95.

Figure 11. Long-term groundwater monitoring of tidal influence in wells at sites on River St.

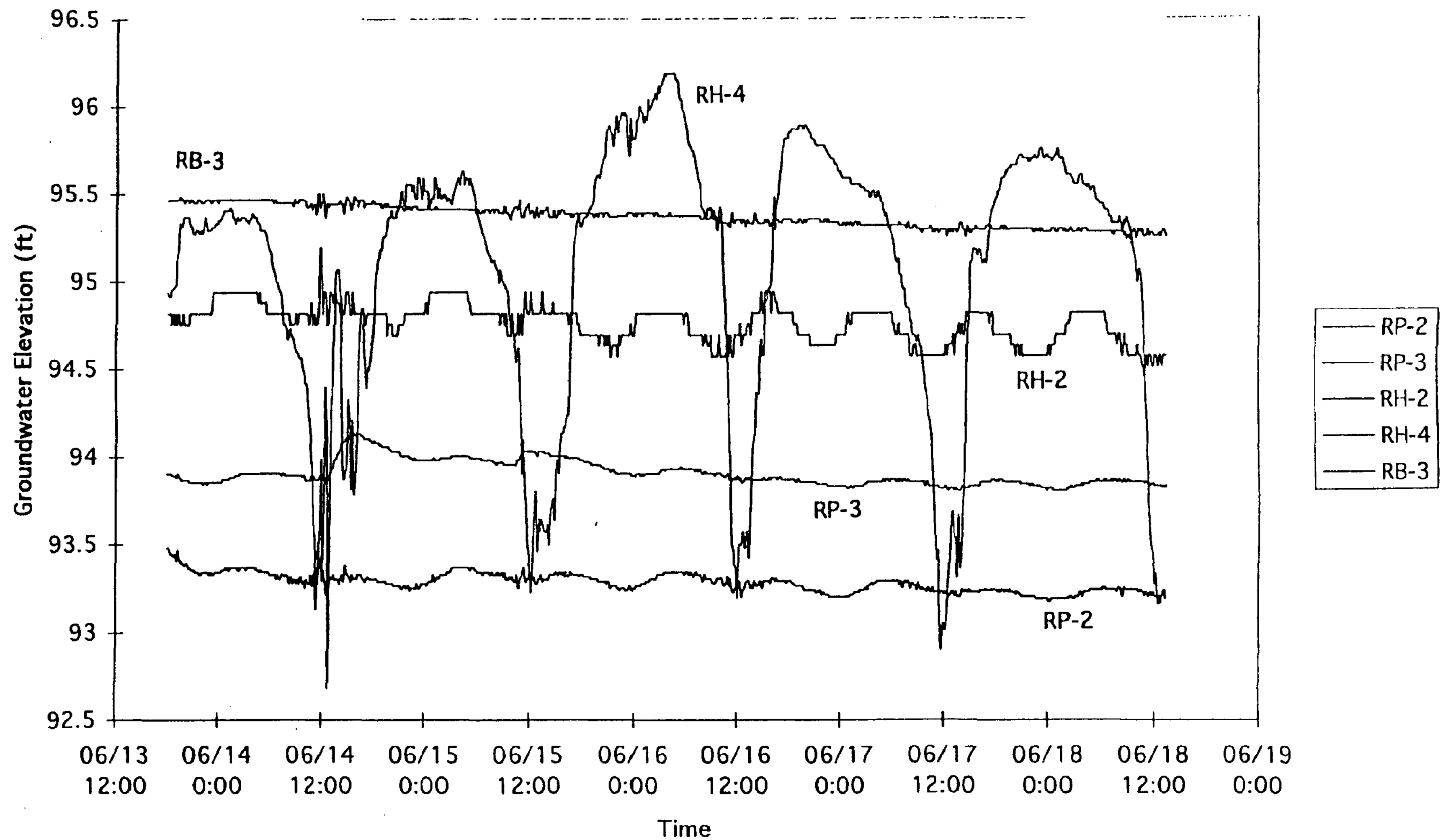


Figure 12. Groundwater flow directions at site WRH during low tide: 3/30/95.

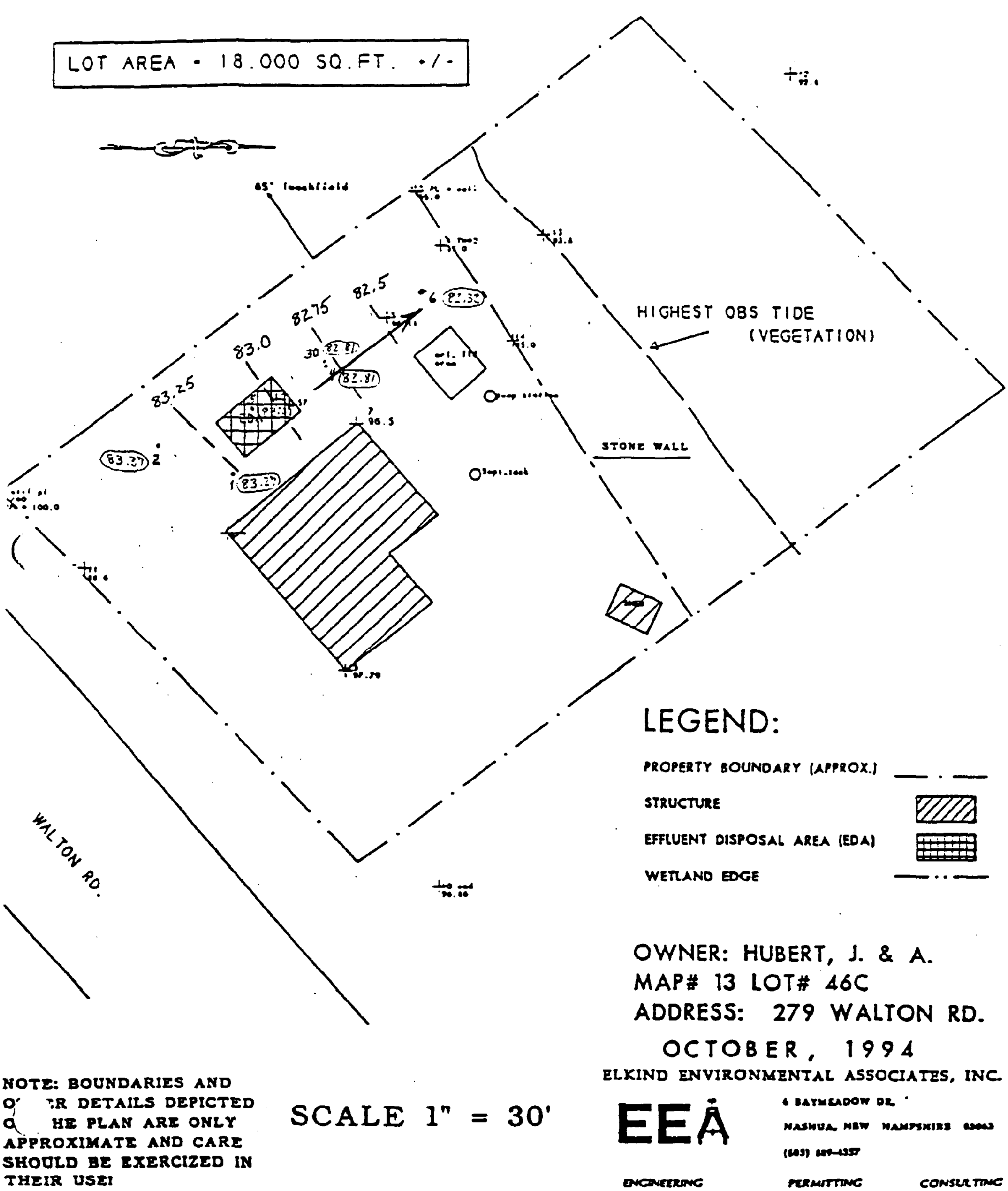


Figure 13. Groundwater flow directions at site WRH during low tide: 6/29/95.

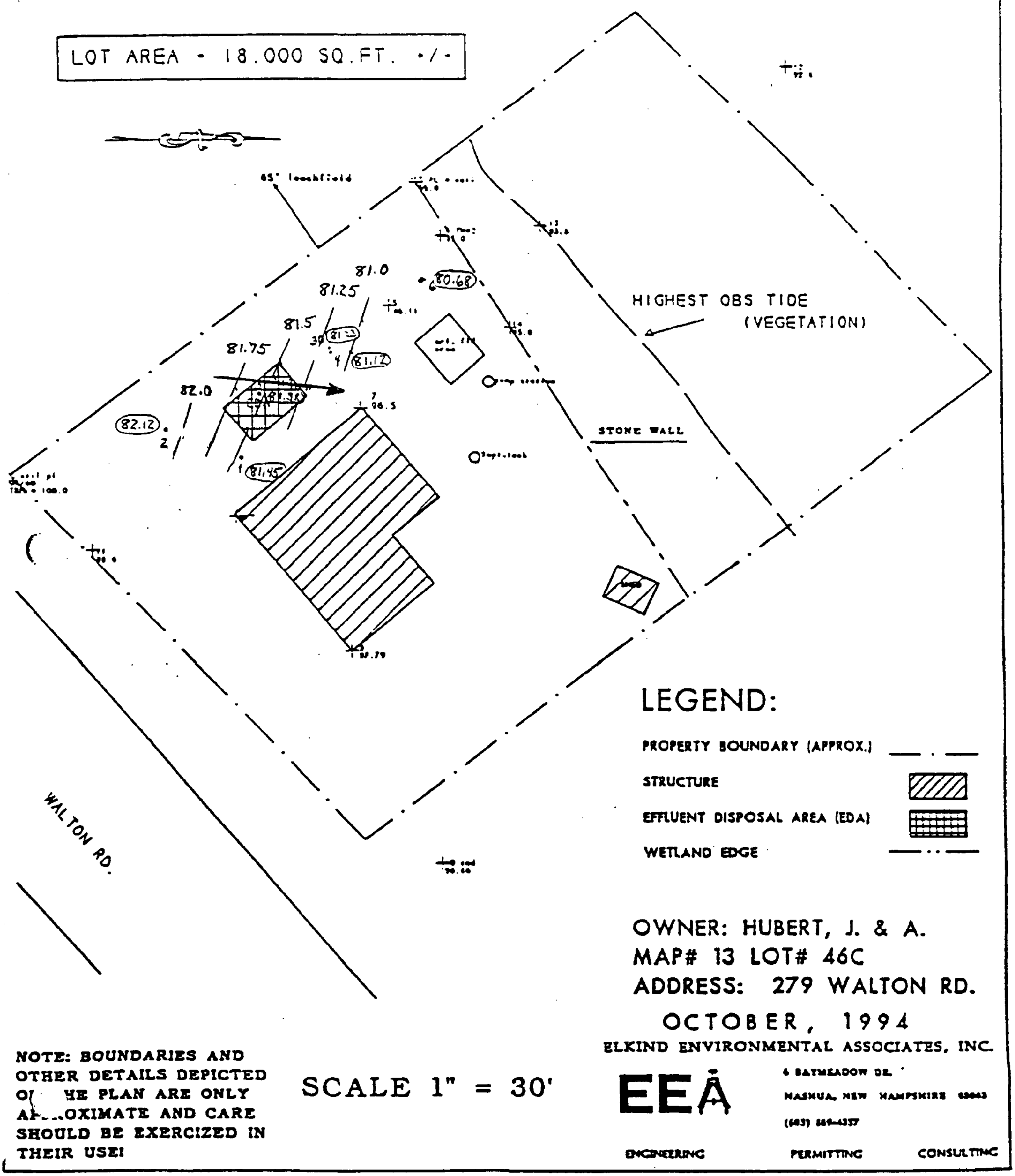


Figure 14. Long-term groundwater monitoring in wells at site WRH: Starting 11/10/95

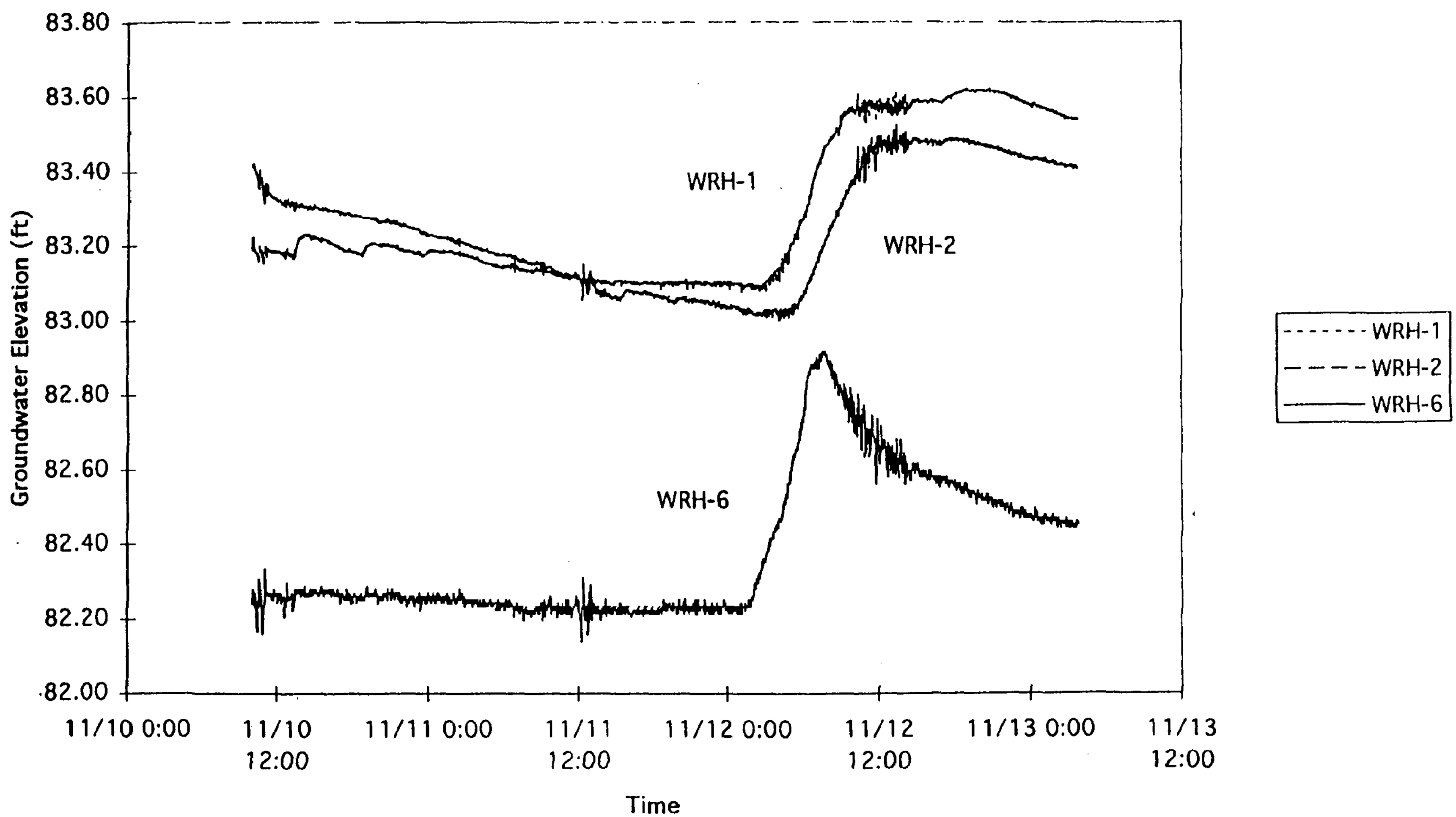


Figure 15. Long-term groundwater monitoring in wells at site KDB.

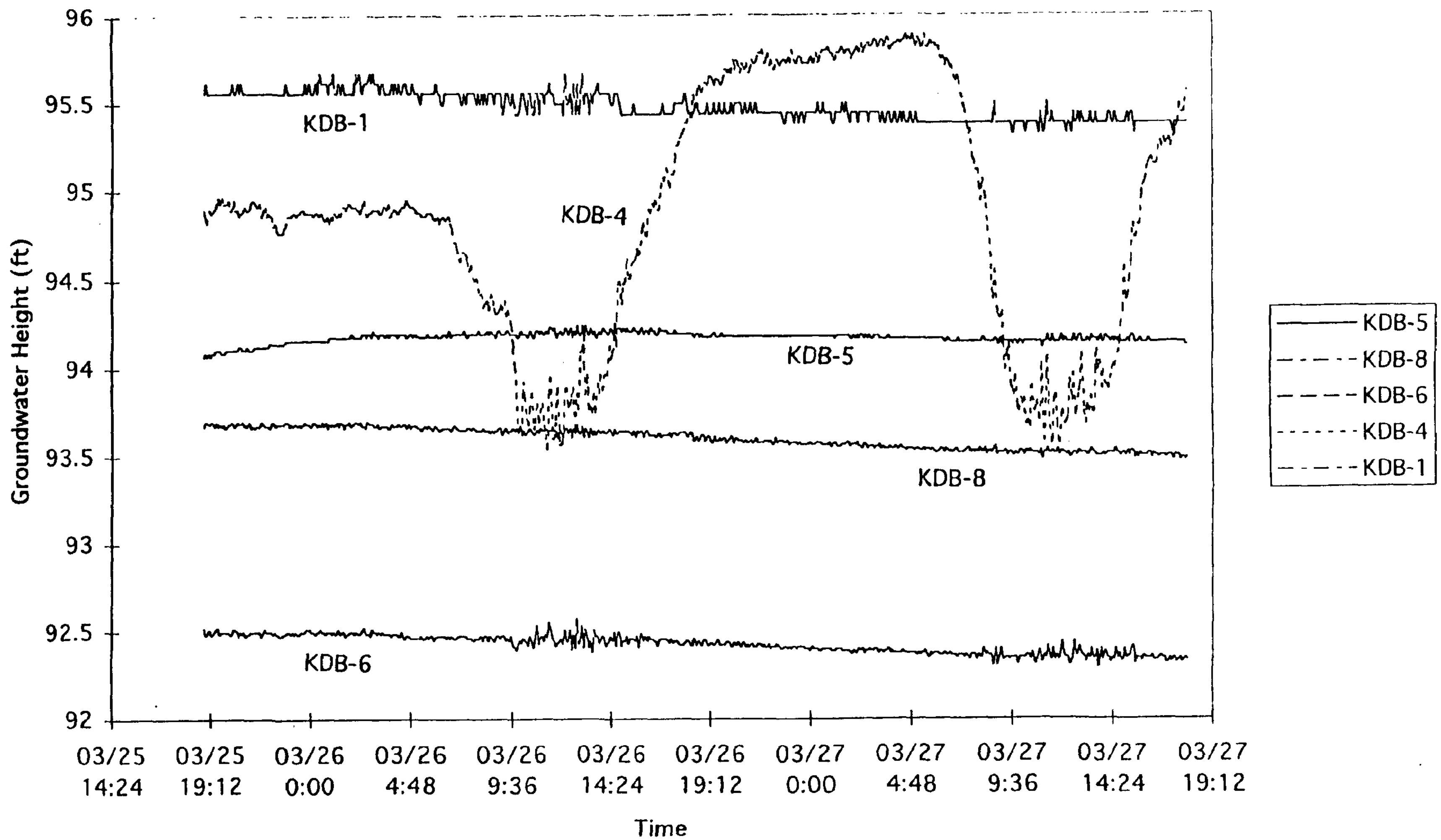
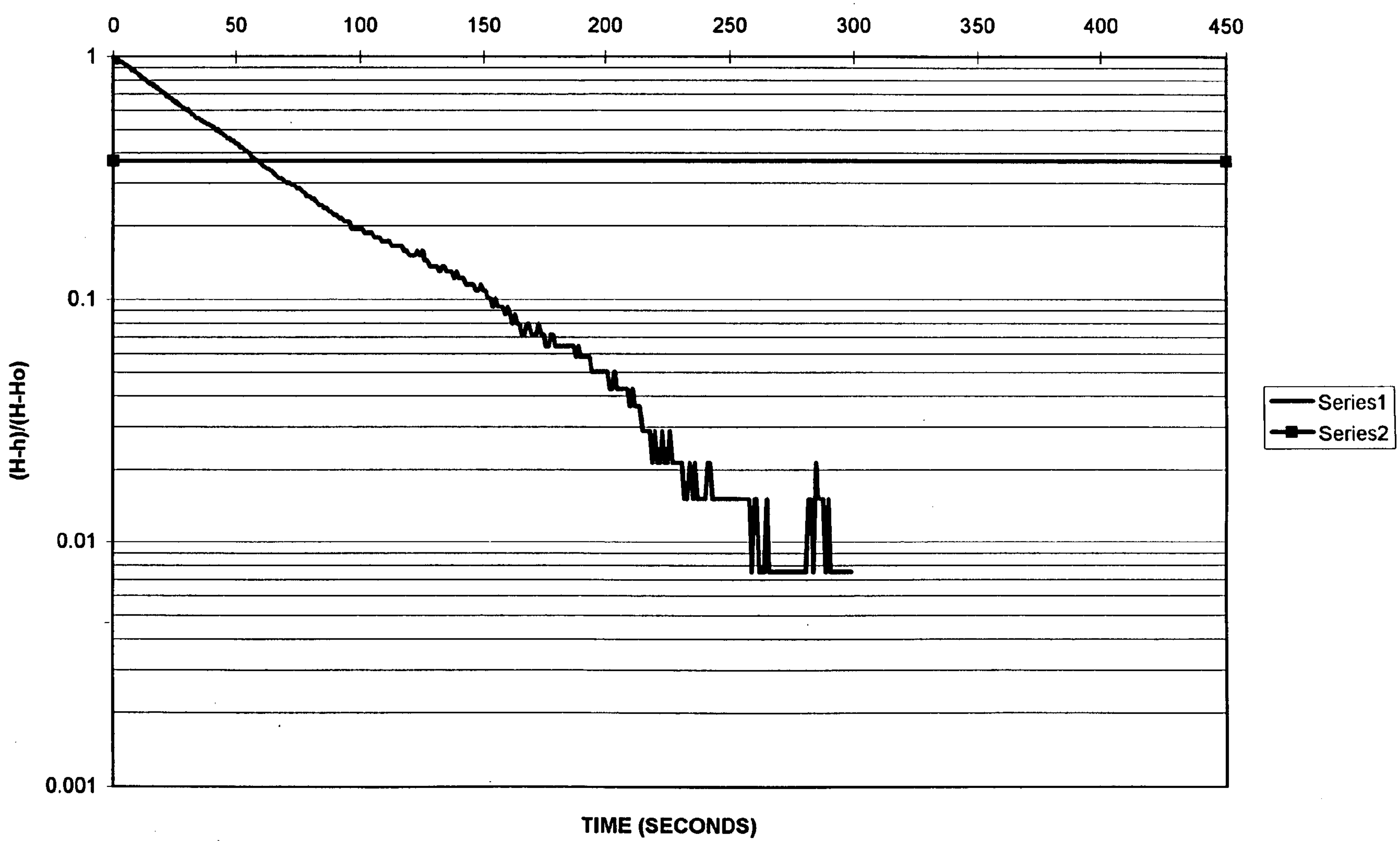


Figure 16. Example slug test results in well RH-4 with a 7/16 diameter 1 foot slug.



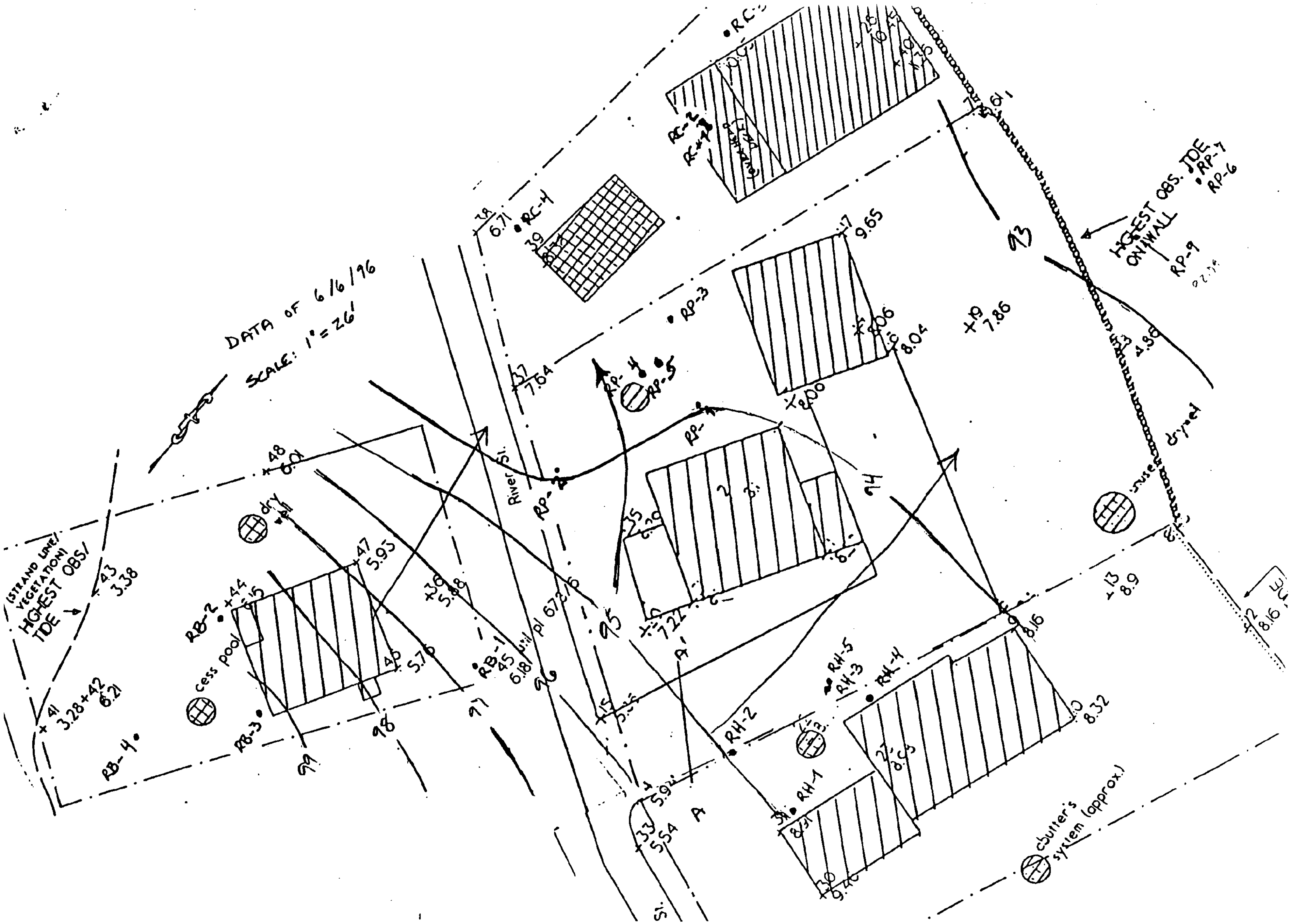


Figure 17. Groundwater flow directions for the combined sites of RB, RC, RP and RH: 6/6/96.

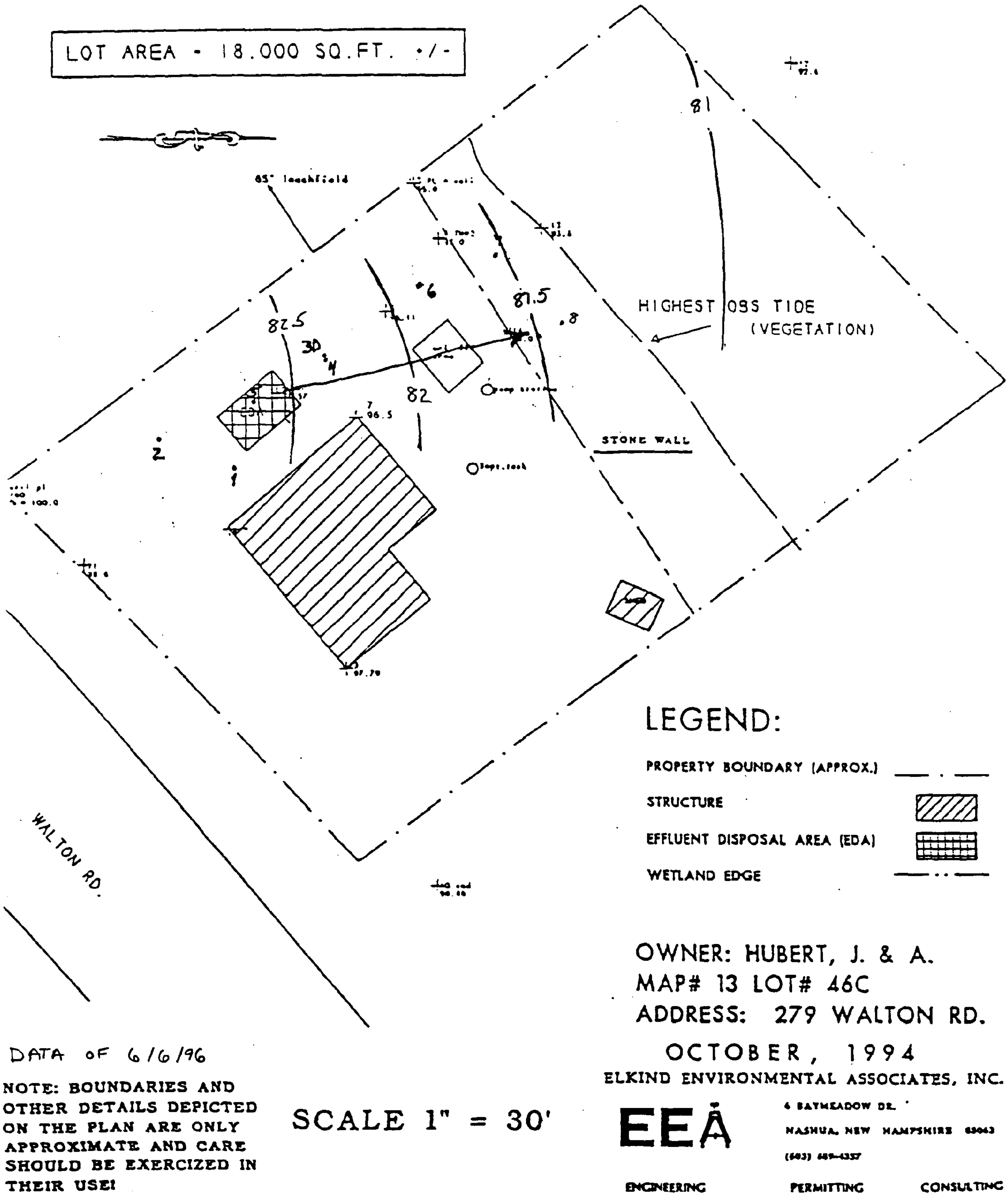
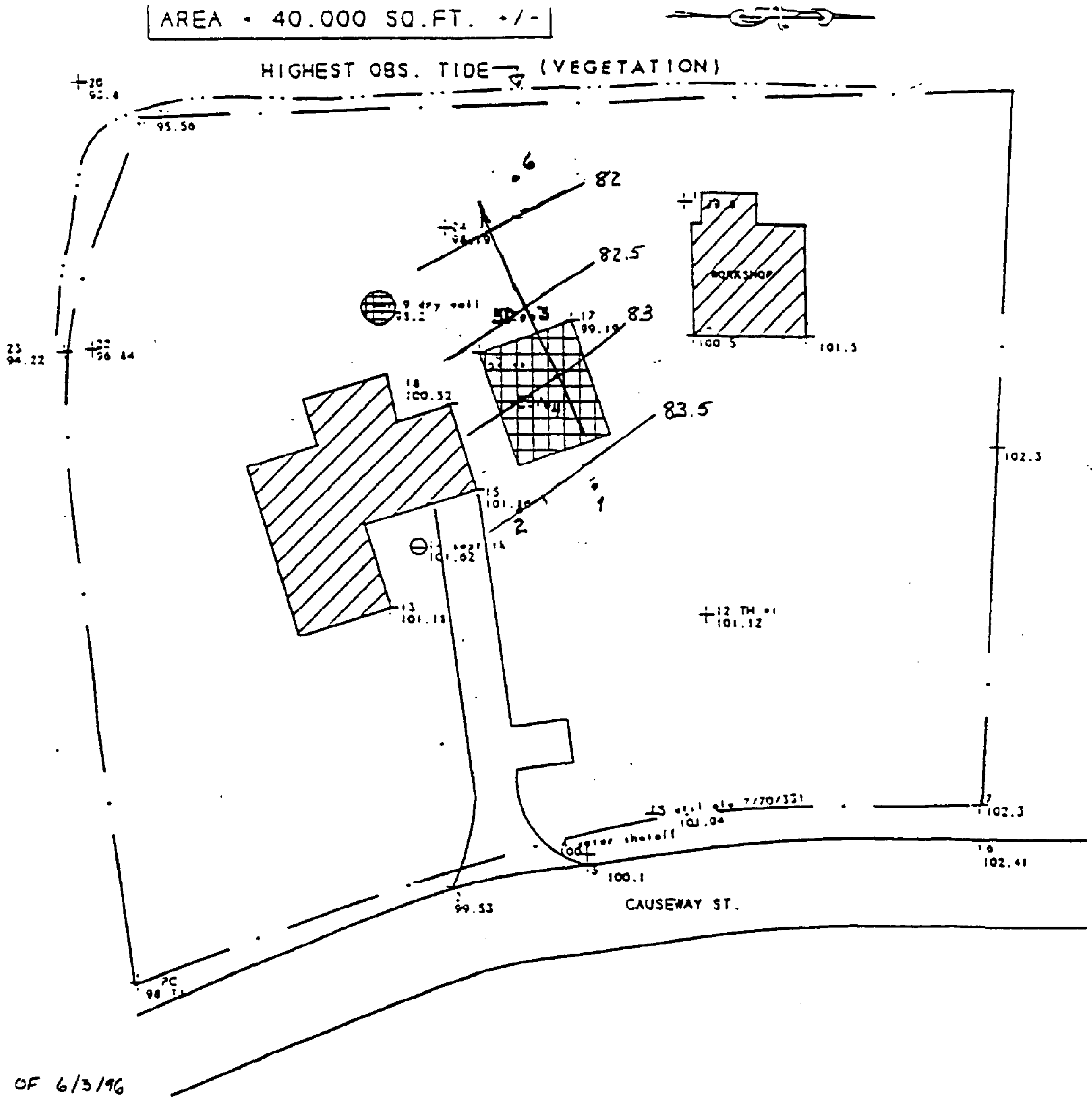


Figure 18. Groundwater flow directions at site WRH: 6/6/96.

Figure 19. Groundwater flow directions at site CSL: 6/3/96.



DATA OF 6/3/96

SCALE 1" = 40'

LEGEND:

PROPERTY BOUNDARY (APPROX.)

STRUCTURE

EFFLUENT DISPOSAL AREA (EDA)

WETLAND EDGE

NOTE: BOUNDARIES AND OTHER DETAILS DEPICTED ON THE PLAN ARE ONLY APPROXIMATE AND CARE SHOULD BE EXERCIZED IN THEIR USE!

OWNER: LOCKE, E.
MAP# 13 LOT# 70
ADDRESS: 41 CAUSEWAY ST.
OCTOBER, 1994

ELKIND ENVIRONMENTAL ASSOCIATES, INC.

EEA

6 BAYMEADOW DR.
NASHUA, NEW HAMPSHIRE 03063
(603) 889-4357

ENGINEERING PERMITTING CONSULTING

Figure 20. Groundwater flow directions at site KDB: 6/6/96.

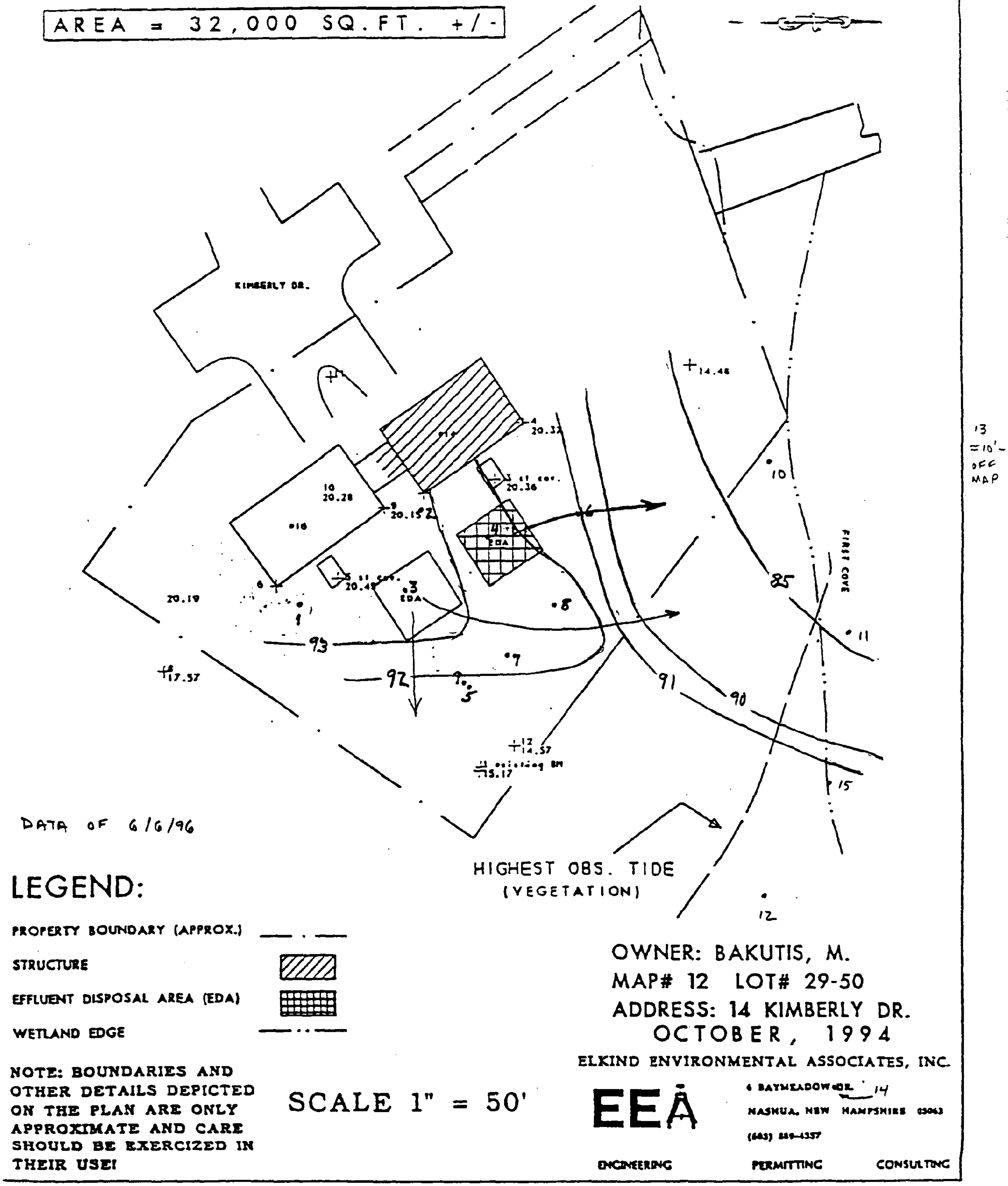
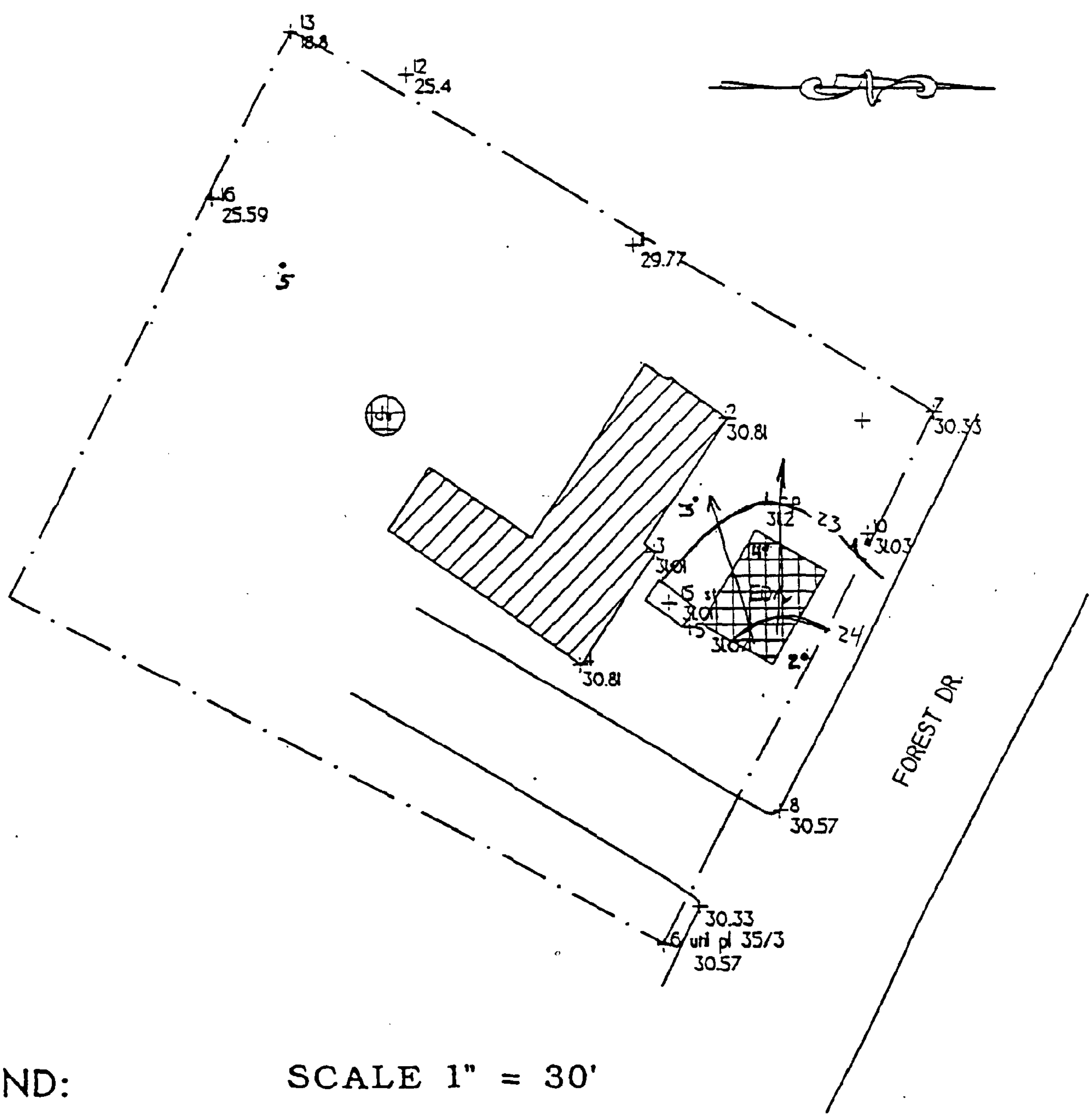


Figure 21. Groundwater flow directions at site FDC: 6/6/96.

AREA = 13,900 SQ. FT. +/-



LEGEND:

SCALE 1" = 30'

PROPERTY BOUNDARY (APPROX.)

STRUCTURE

EFFLUENT DISPOSAL AREA (EDA)

WETLAND EDGE

NOTE: BOUNDARIES AND OTHER DETAILS DEPICTED ON THE PLAN ARE ONLY APPROXIMATE AND CARE SHOULD BE EXERCIZED IN THEIR USE!

OWNER: CRONIN, P.
MAP# 9 LOT# 141
ADDRESS: 6 FOREST DR.
OCTOBER, 1994

ELKIND ENVIRONMENTAL ASSOCIATES, INC.

EEA

6 BAYMEADOW DR.
NASHUA, NEW HAMPSHIRE 03063
(603) 889-4357

ENGINEERING PERMITTING CONSULTING

Figure 22.

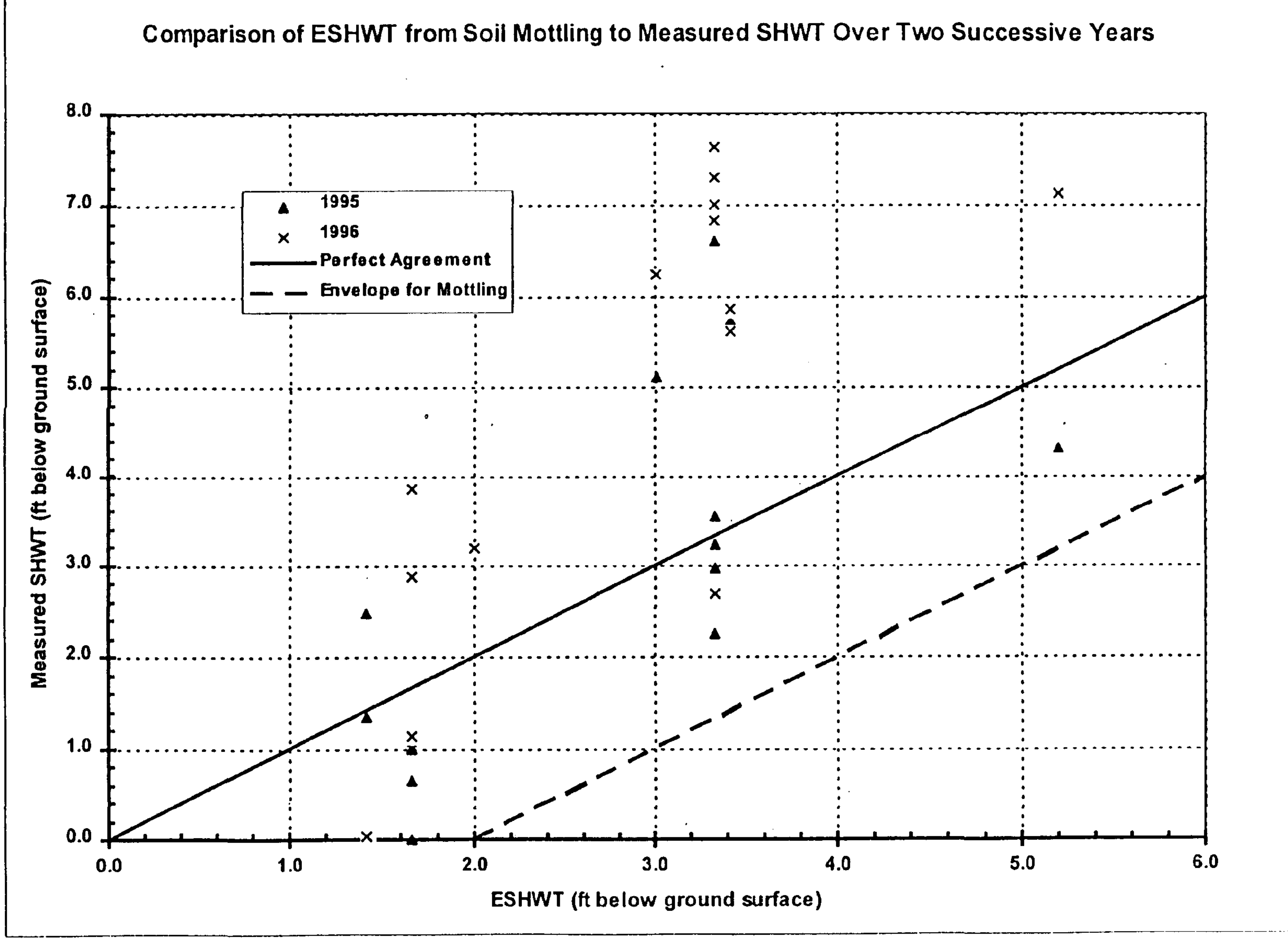

Comparison of ESHWT from Soil Mottling to Measured SHWT Over Two Successive Years
1995
1996
Perfect Agreement
Envelope for Mottling
Measured SHWT (ft below ground surface)
ESHWT (ft below ground surface)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0

FIGURE 23

HAMPTON HARBOR STUDY AREA

Surface Water Sampling Sites
and Shellfish Harvesting Classifications

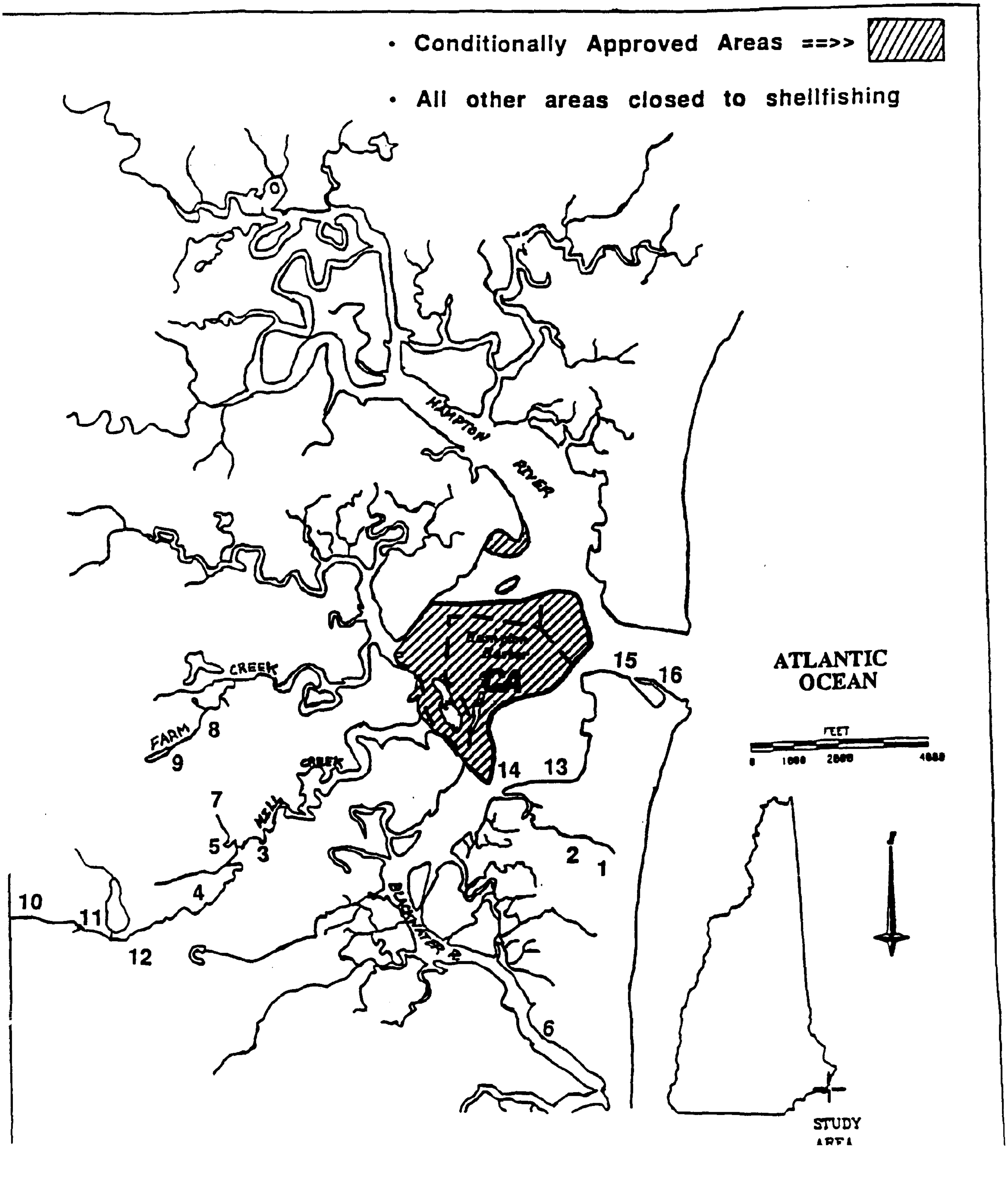


FIGURE 24A
SITE WRH
Mean Nutrient Concentrations in Wells and Lysimeter

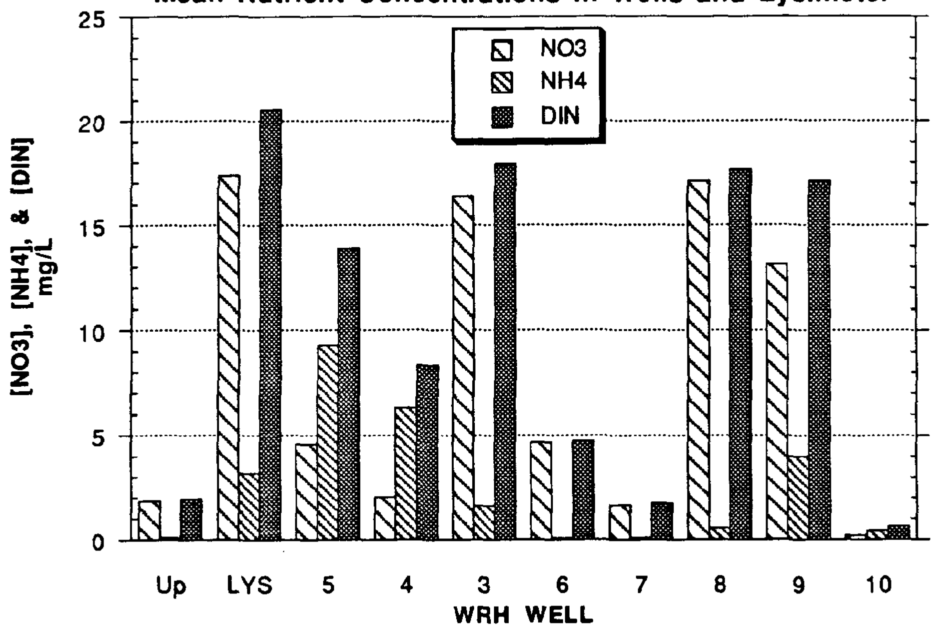


FIGURE 24B
SITE WRH
Mean Phosphate Concentrations in Wells & Lysimeter

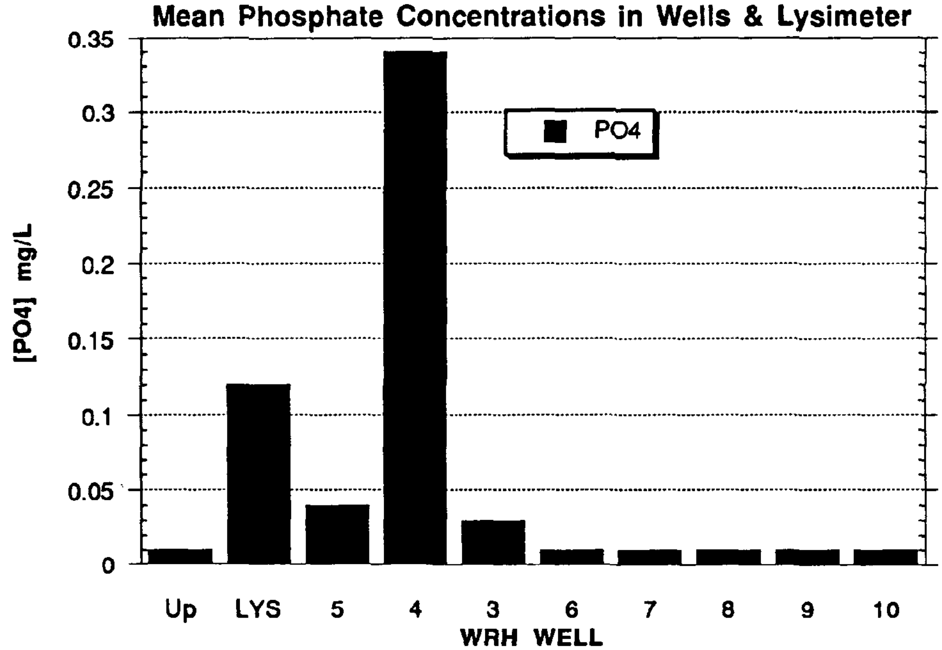


FIGURE 24C
SITE WRH
Water Table Depth in Relationship to Bottom of EDA
February 1995 to May 1996

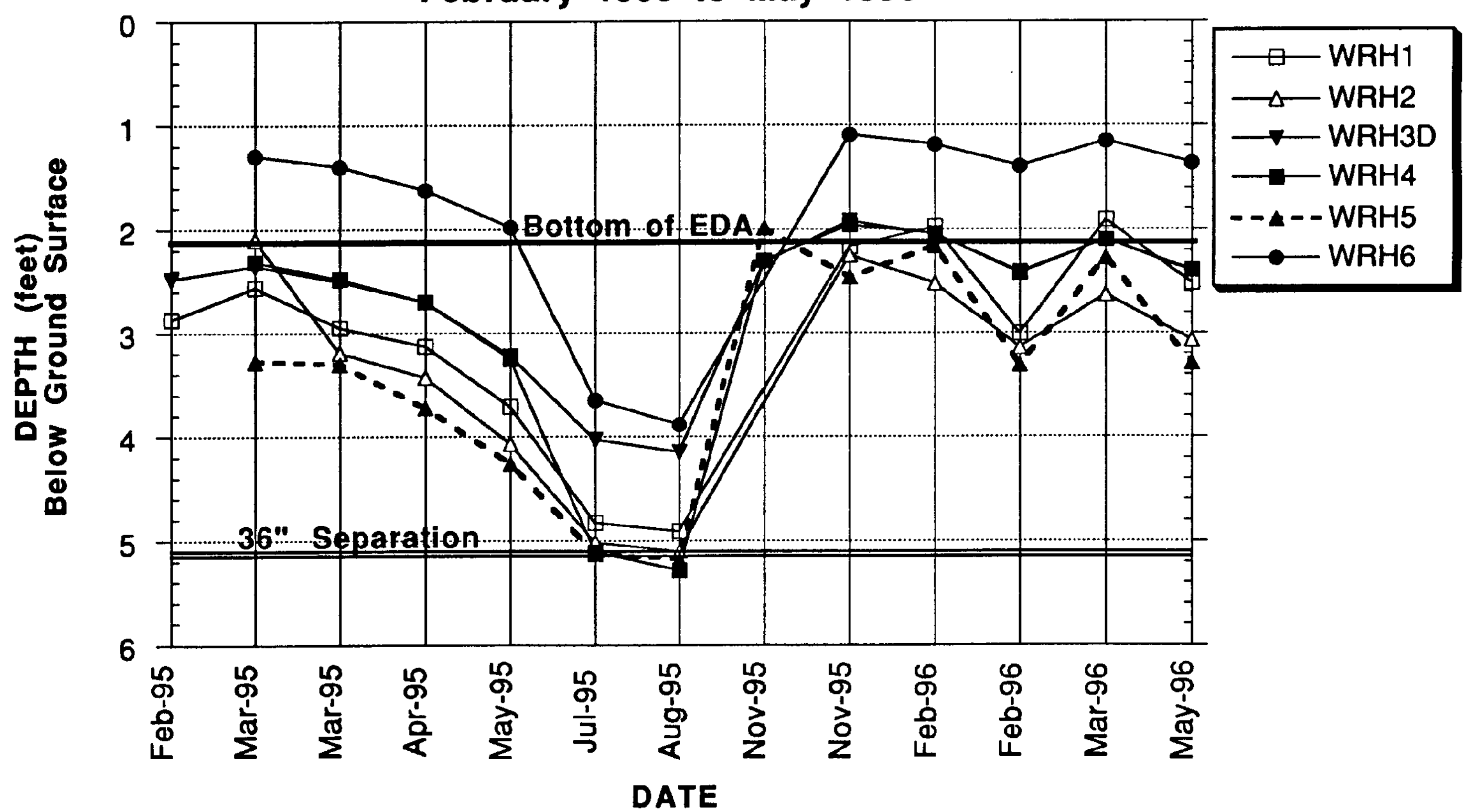


FIGURE 24D
SITE WRH
EDA Treatment with respect to Groundwater Depth
January 1995 to May 1996

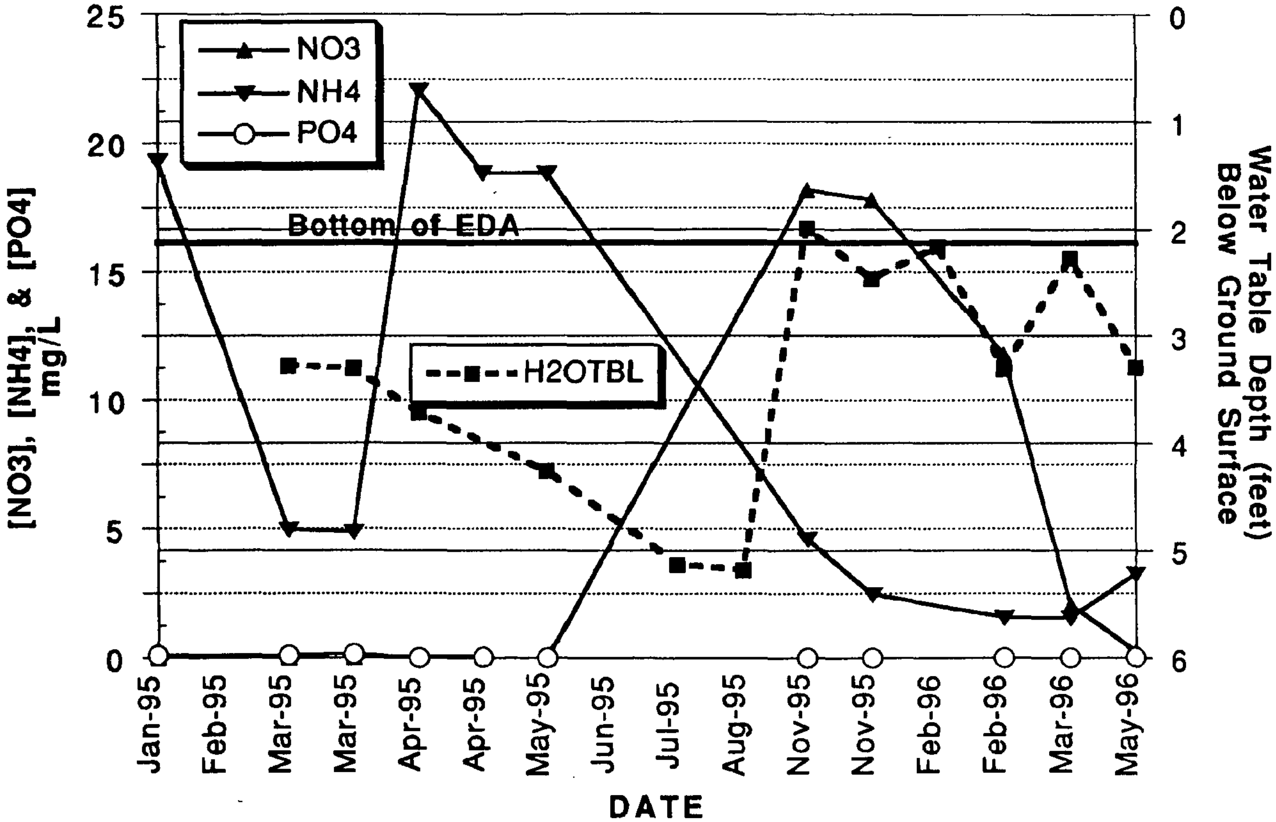


FIGURE 24E
SITE WRH
Relationship of EDA Water Table Depth and Nutrient Levels in Lysimeter Samples
August 1995 to June 1996

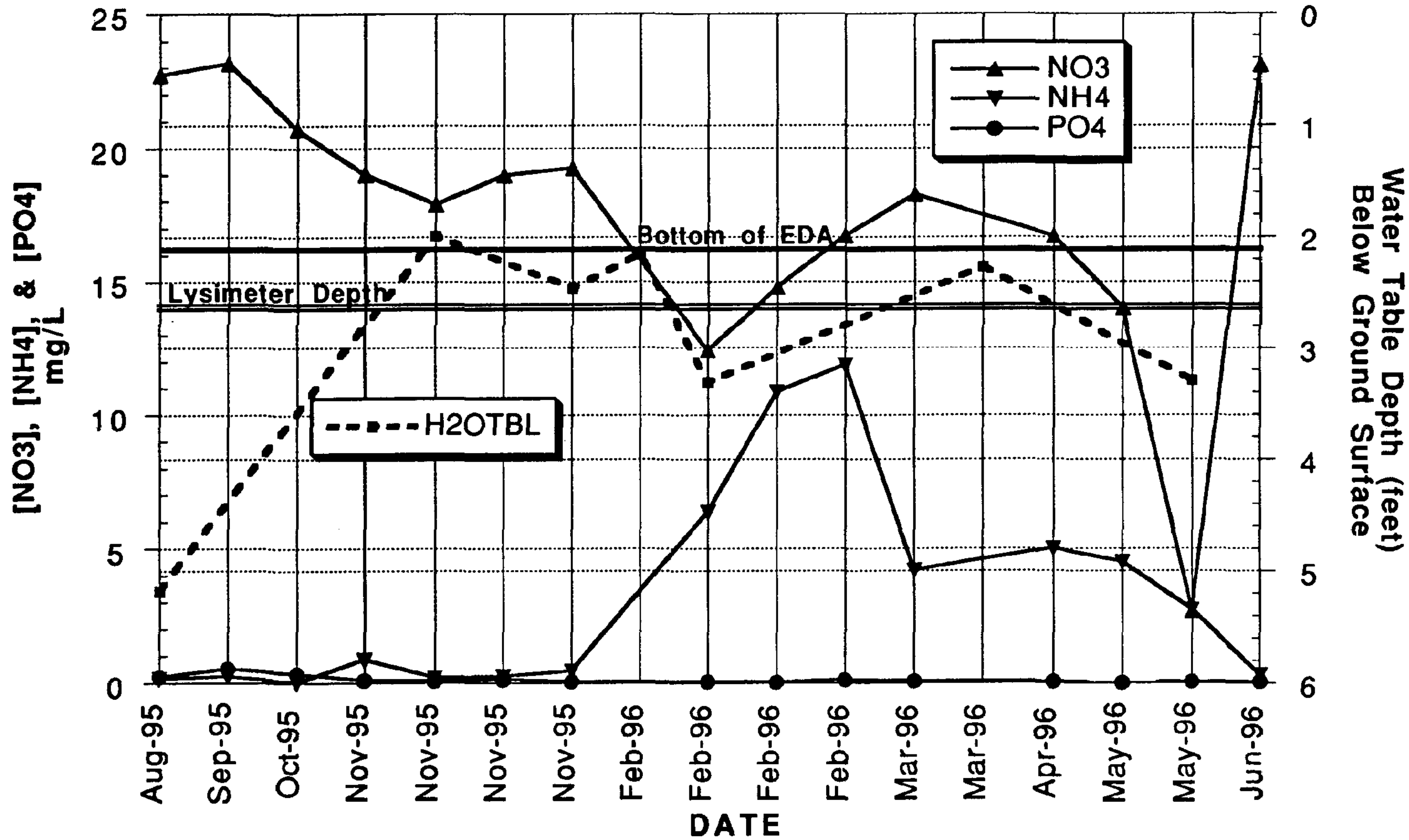


FIGURE 25A
SITE CSL
Mean N-species Concentrations in Wells & Lysimeter

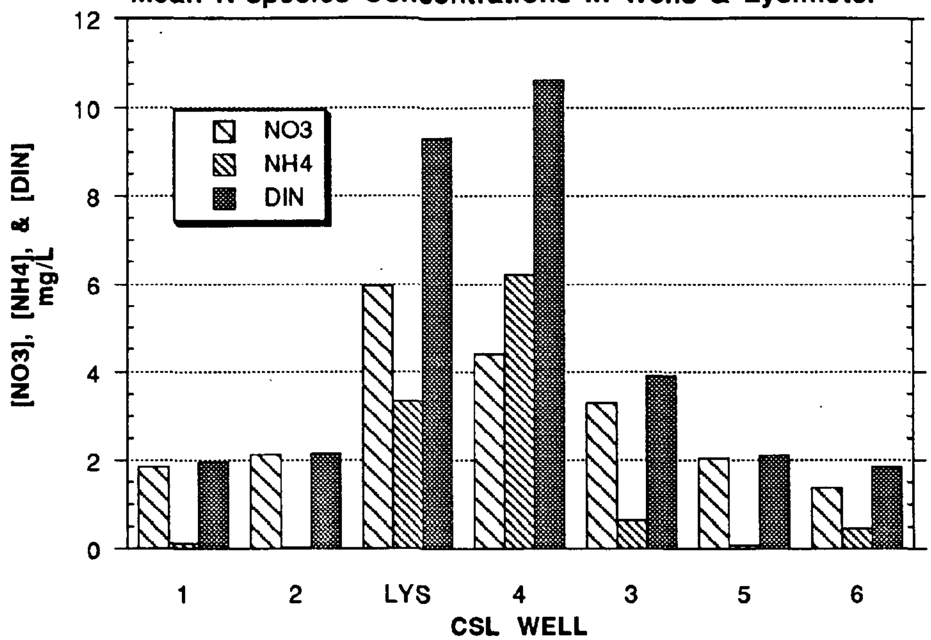


FIGURE 25B
SITE CSL
Mean PO4 Concentrations in Wells & Lysimeter

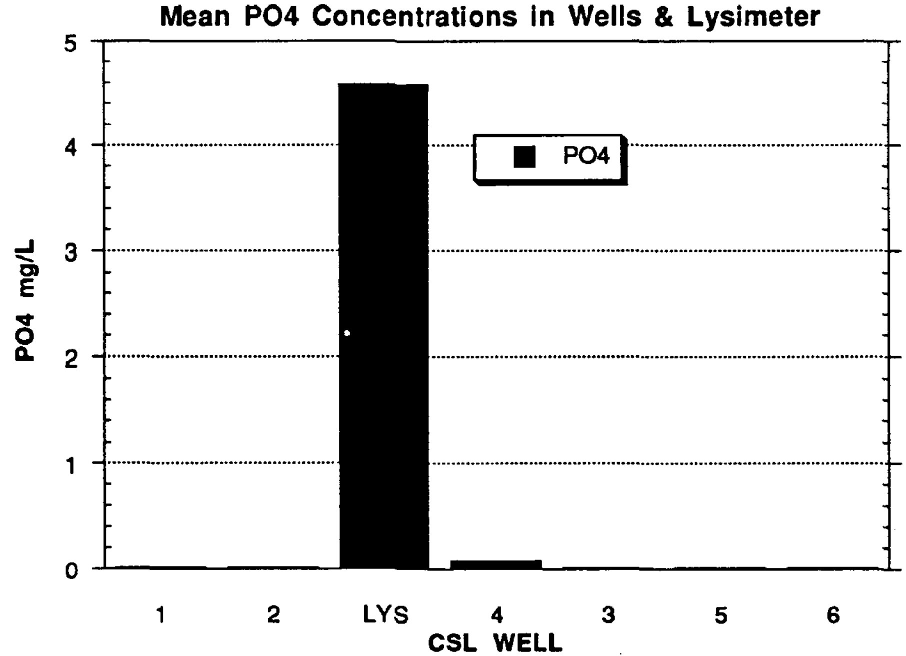


FIGURE 25C
SITE CSL
Water Table Depth in Relation to Bottom of EDA
February 1995 to June 1996

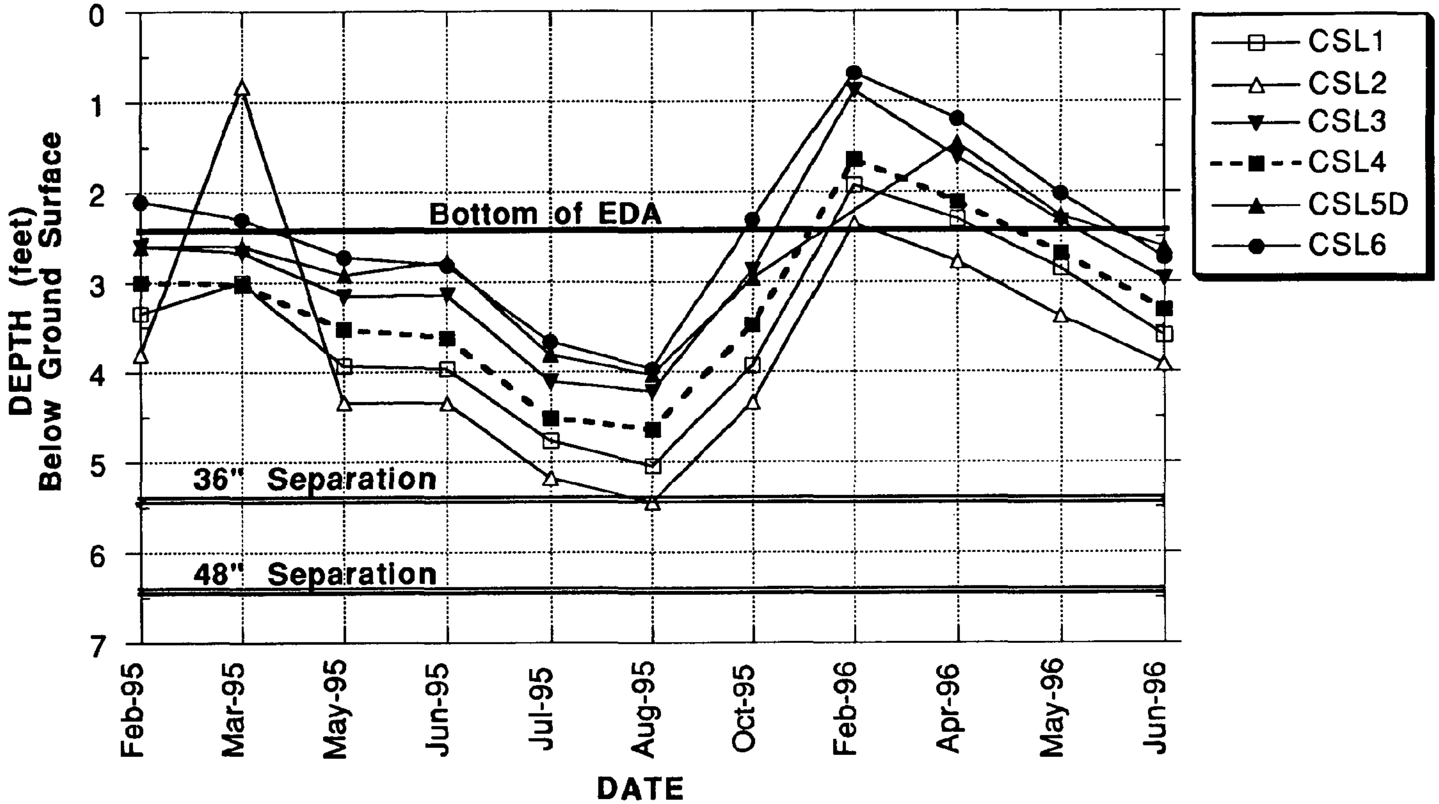


FIGURE 25D
SITE CSL
EDA Treatment with respect to Groundwater Depth
January 1995 to May 1996

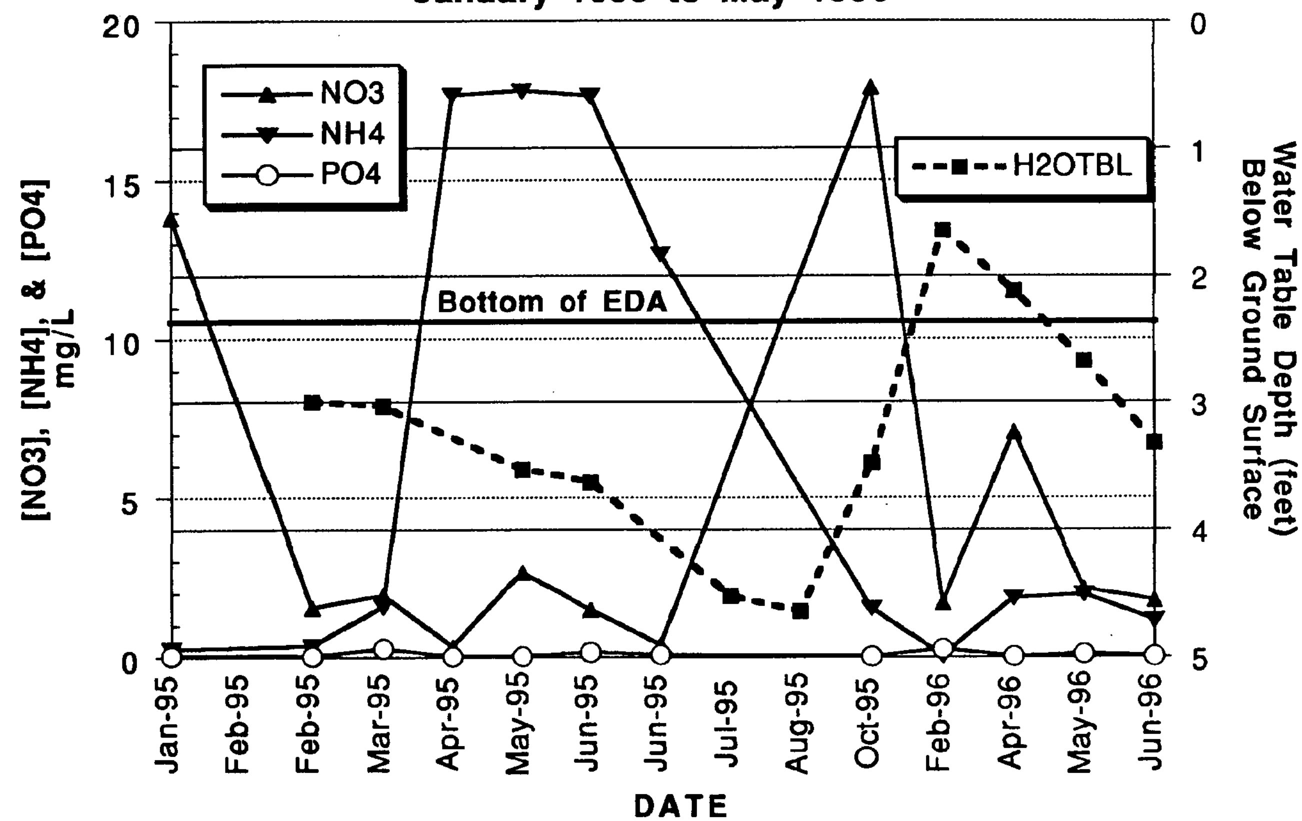


FIGURE 25E
SITE CSL
Relationship of EDA Water Table Depth and Nutrient Levels in Lysimter Samples
August 1995 to June 1996

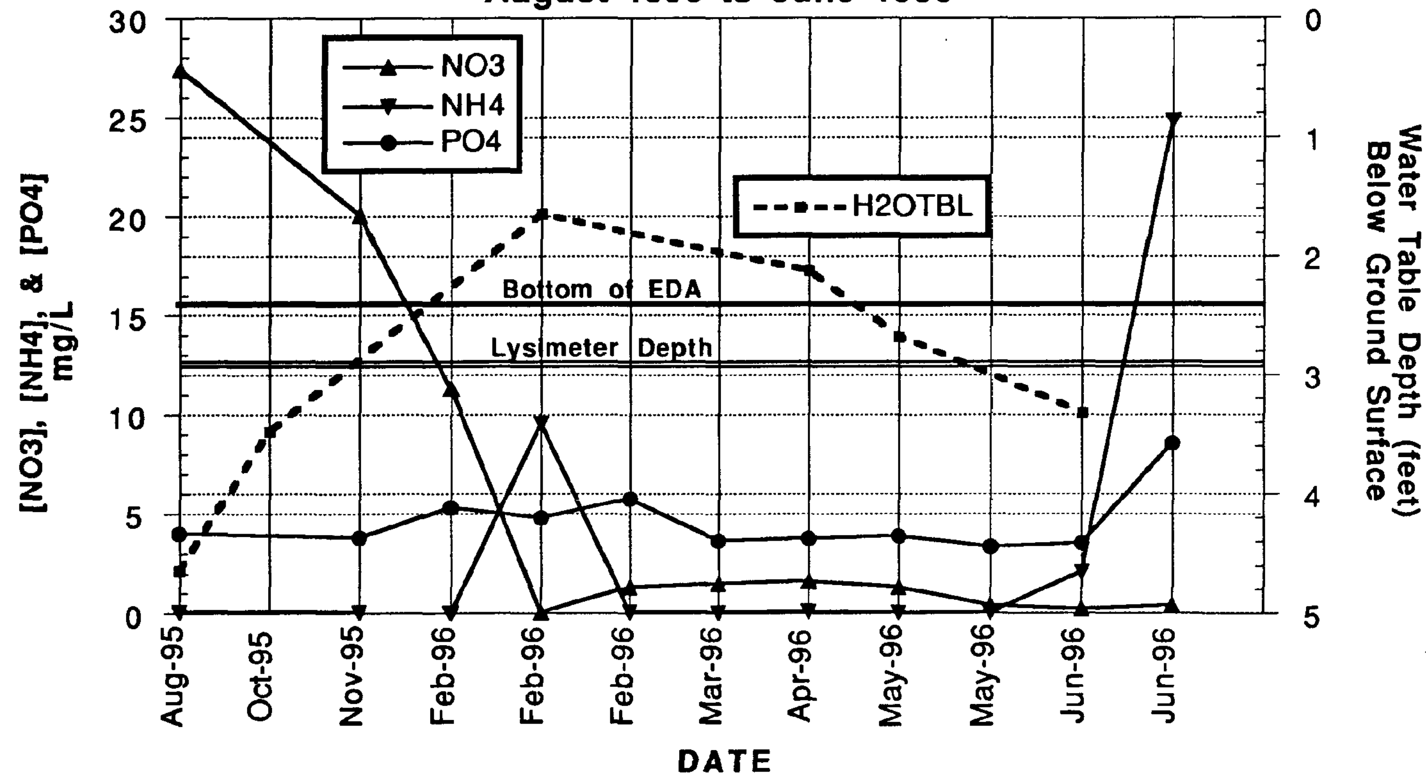


FIGURE 26A
SITE KDB
Mean N-species in Wells and Lysimeters

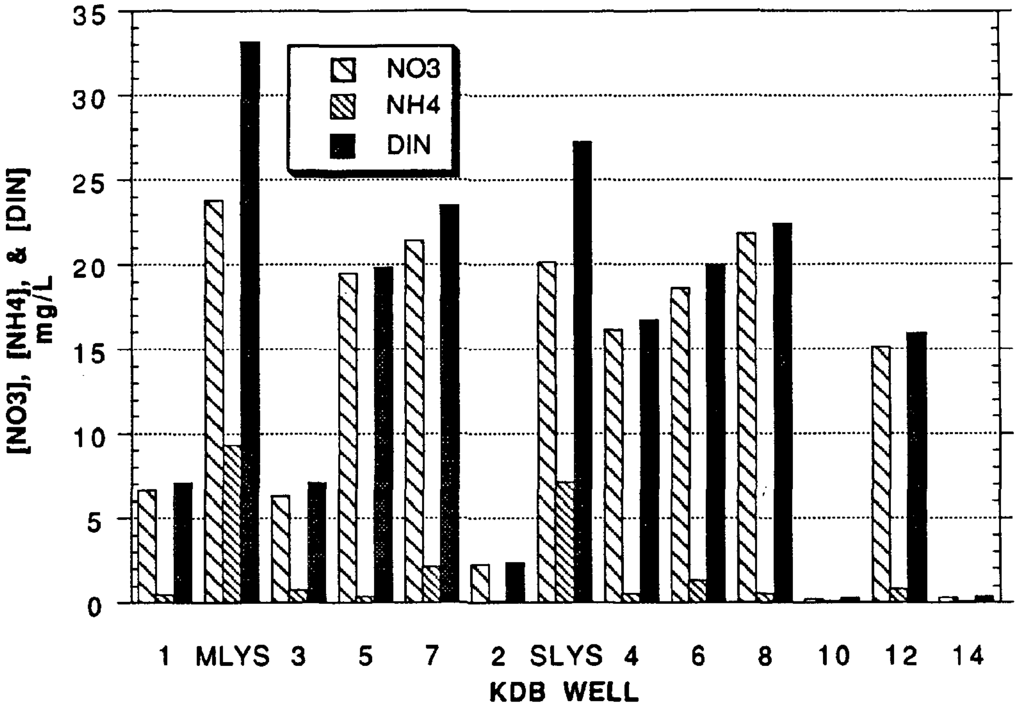


FIGURE 26B
SITE KDB
Mean PO4 in Wells and Lysimeters

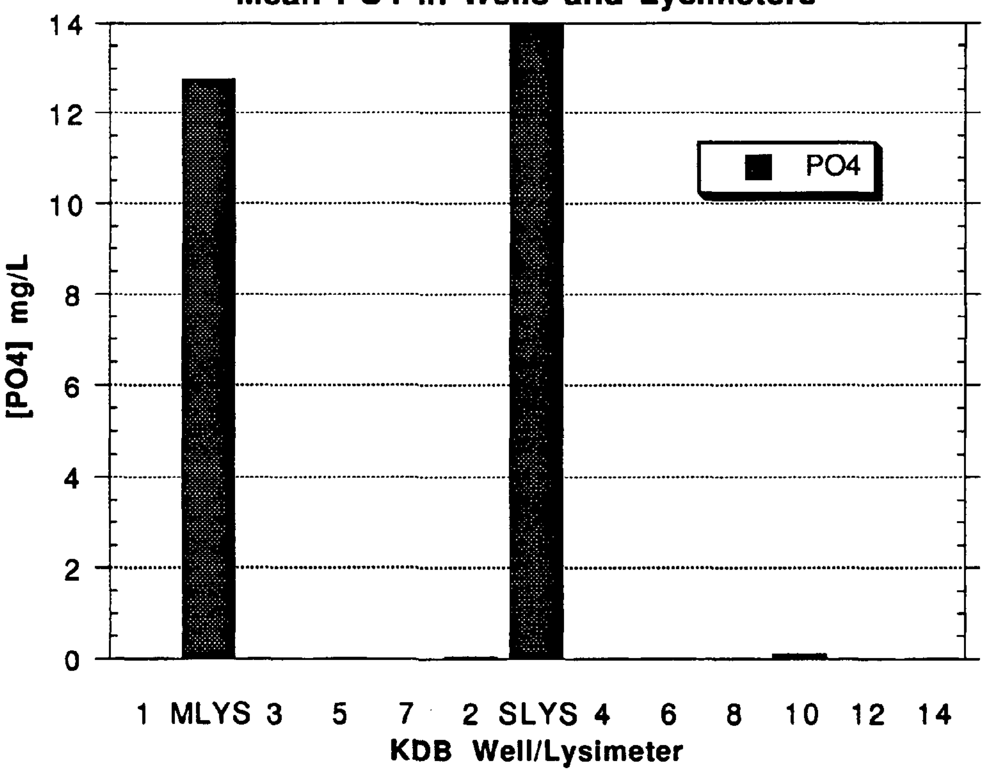


FIGURE 26C
SITE KDBM
Water Table Depth in Relationship to Bottom of EDA
March 1995 to May 1996

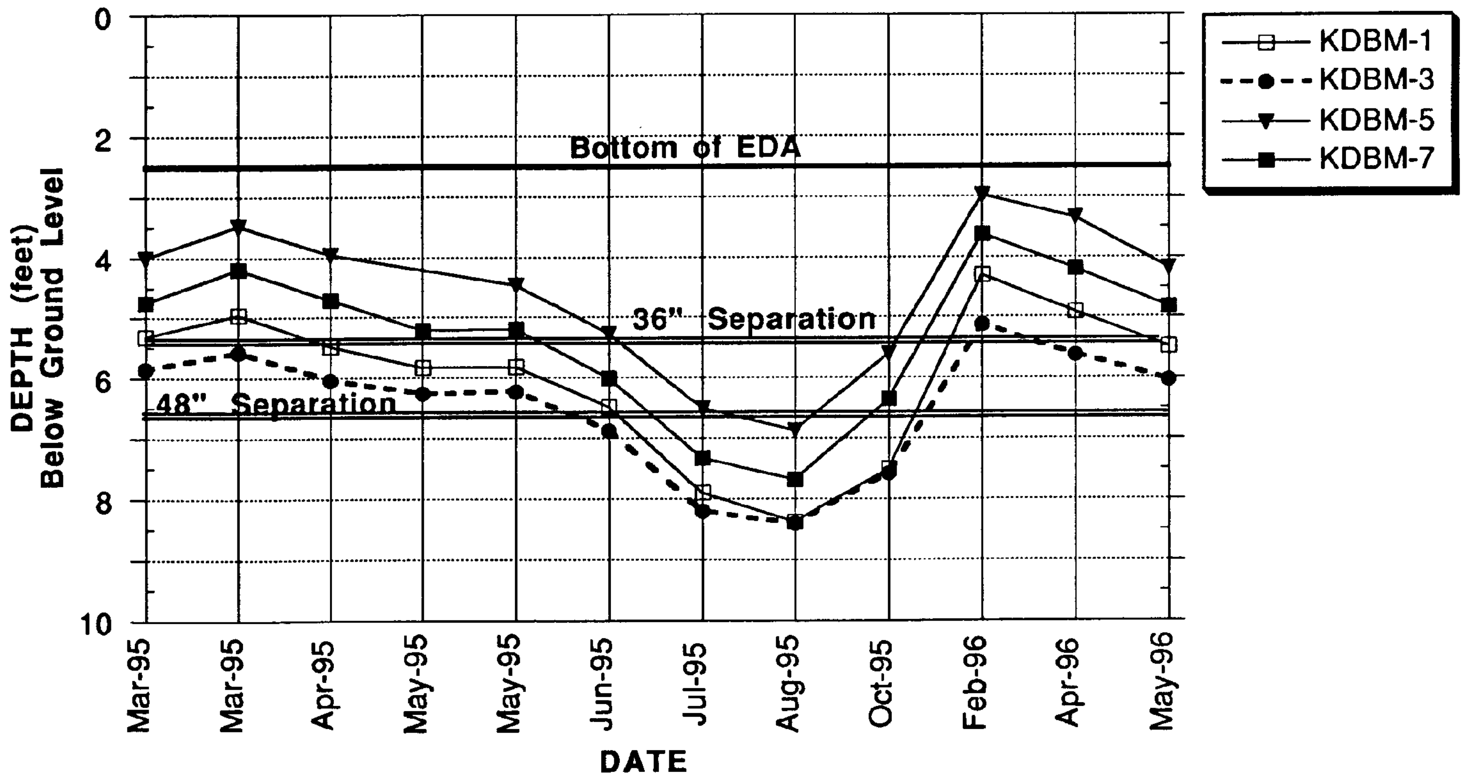


FIGURE 26D
SITE KDBS
Water Table Depth in Relationship to Bottom of EDA
March 1995 to May 1996

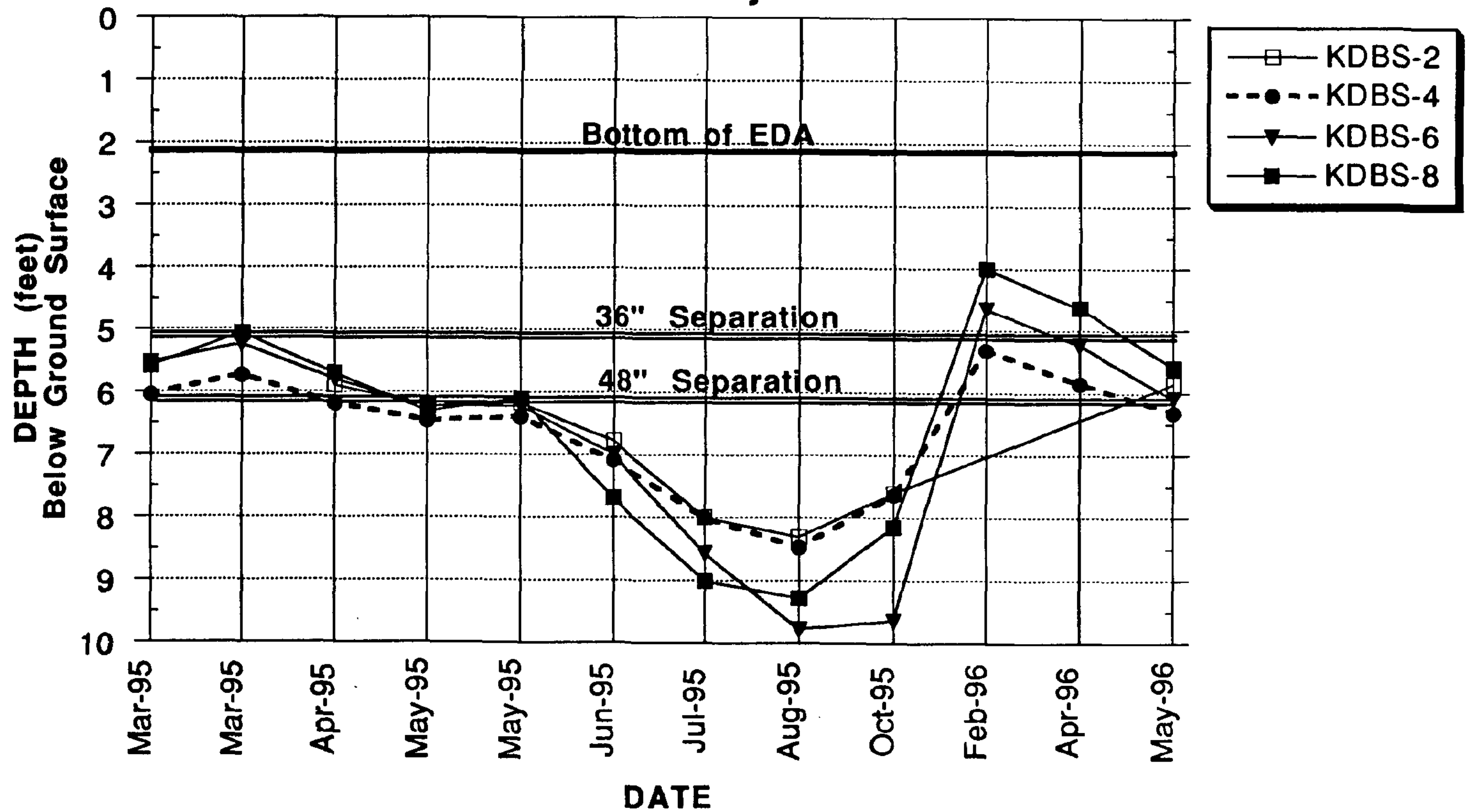


FIGURE 26E
SITE KDBM
EDA Treatment with respect to Groundwater Depth
January 1995 to May 1996

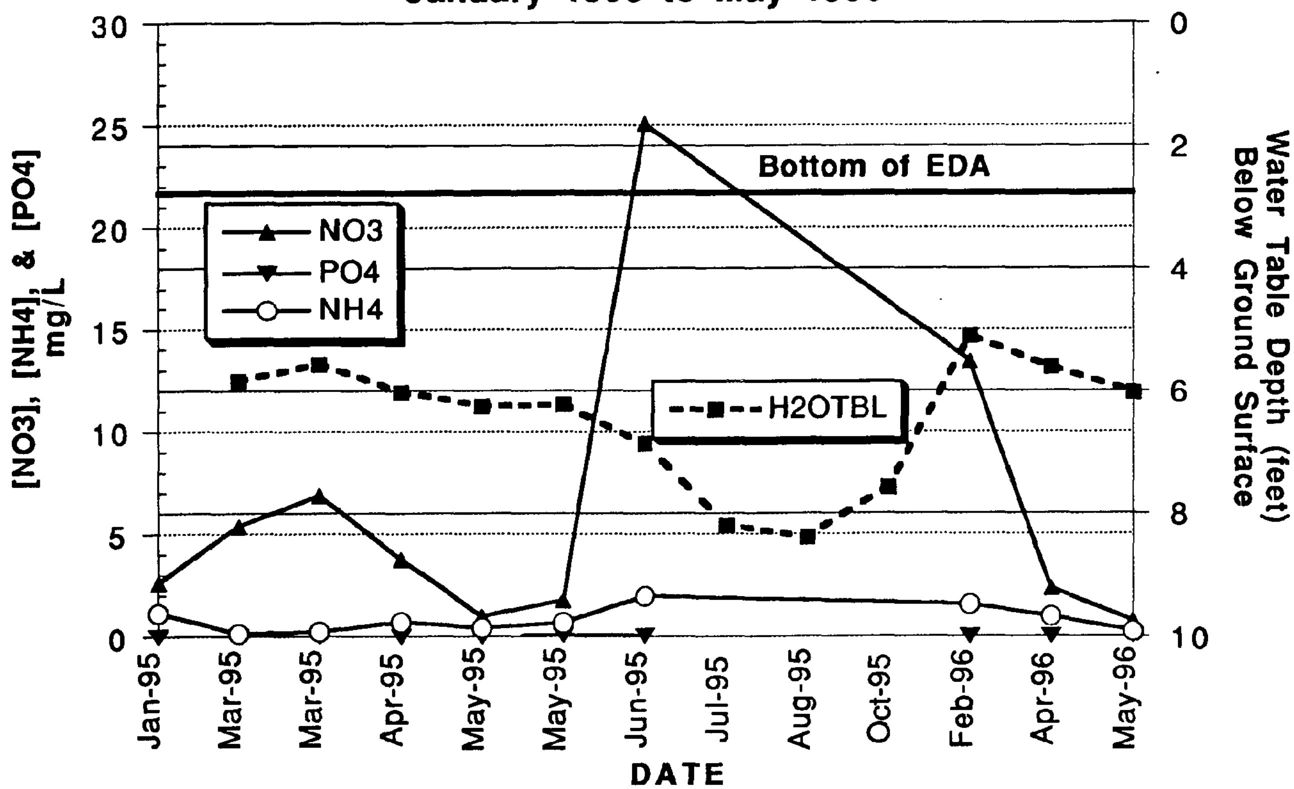


FIGURE 26F
SITE KDBS
EDA Treatment with respect to Groundwater Depth
January 1995 to June 1996

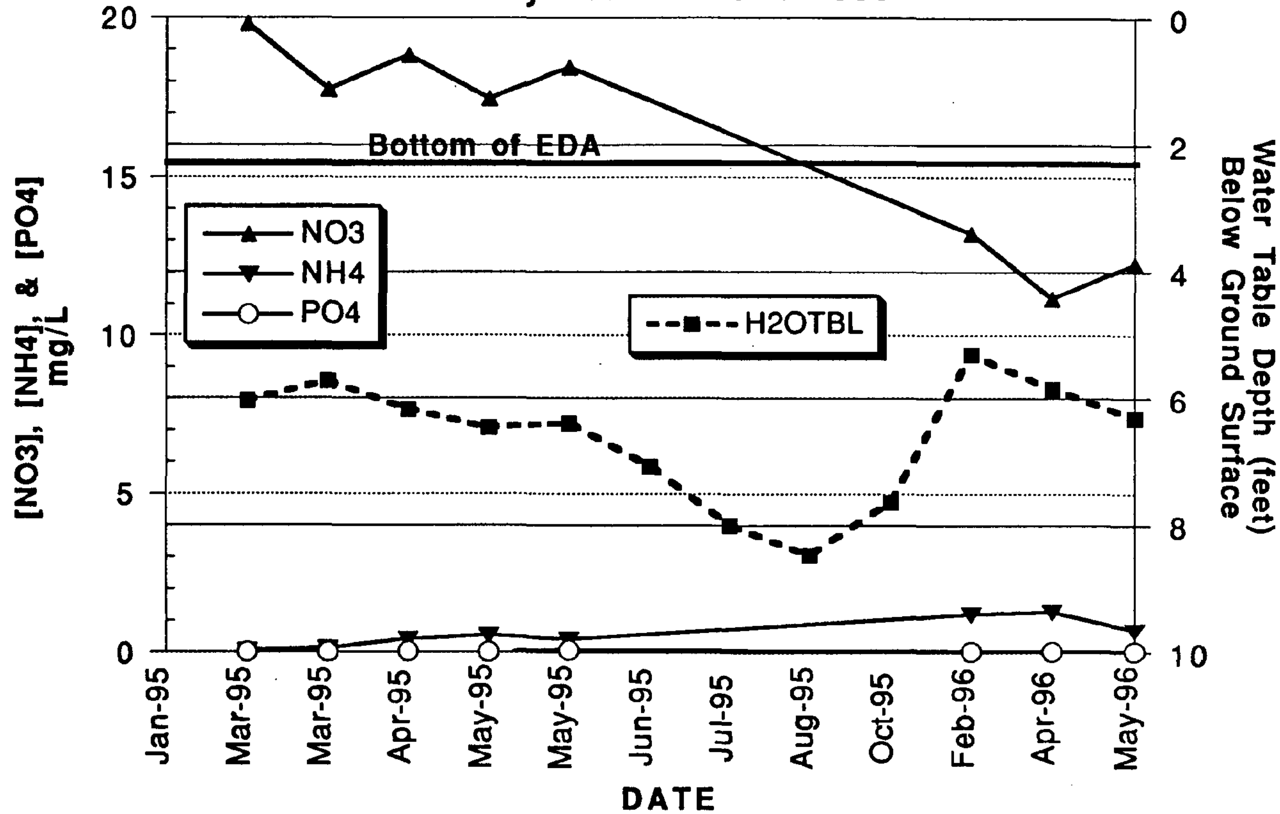


FIGURE 26G
SITE KDBS
Relationship of EDA Water Table Depth and Nutrient Levels in Lysimeter Samples
August 1995 to May 1996

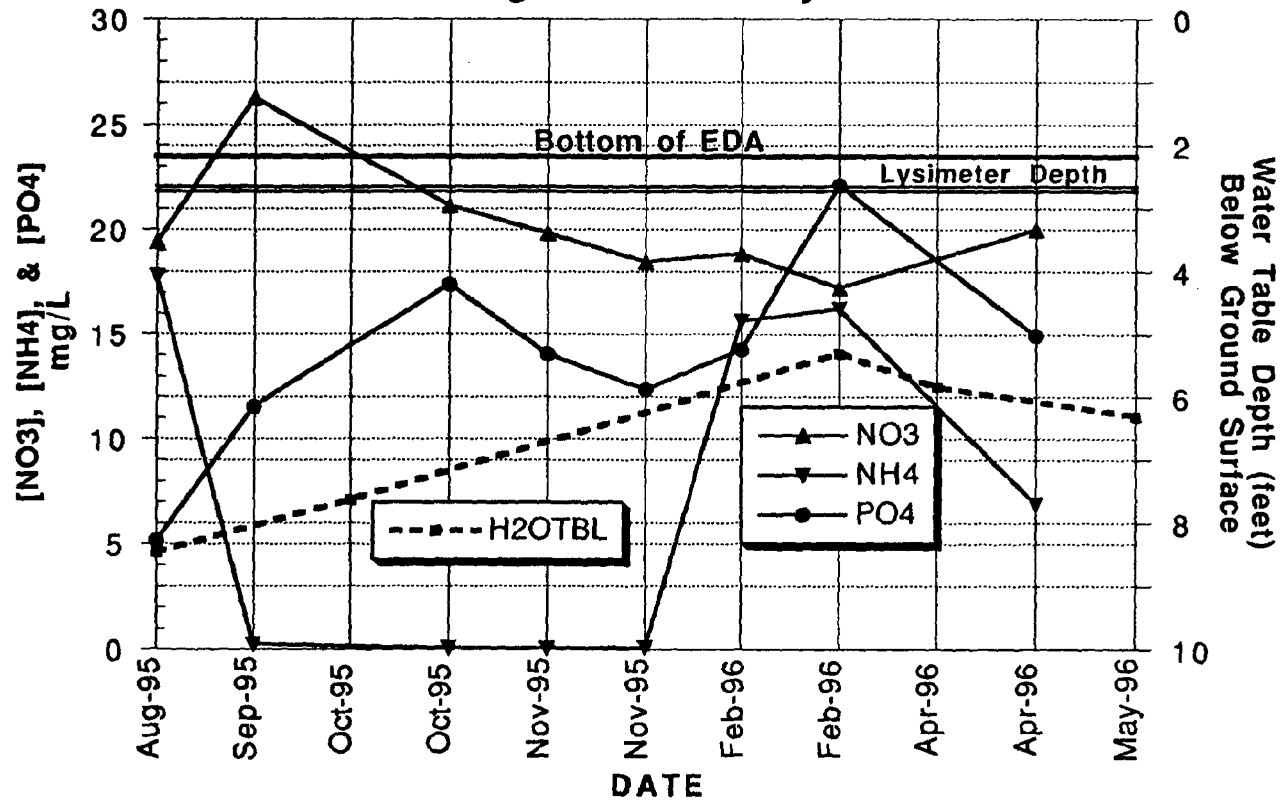


FIGURE 26H
SITE KDBM
Relationship of EDA Water Table Depth and Nutrient Levels in Lysimeter Samples
August 1995 to June 1996

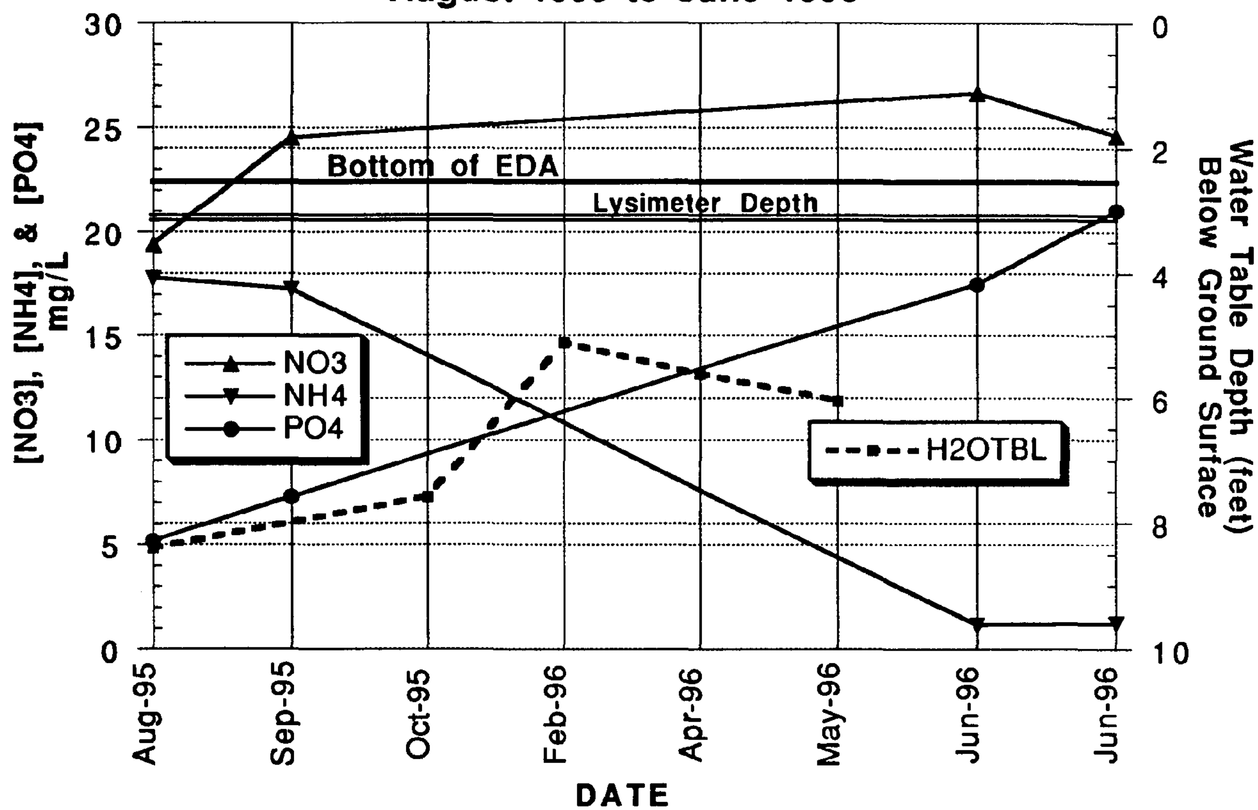


FIGURE 27A
SITE REH
Mean N-species in Well Water Samples

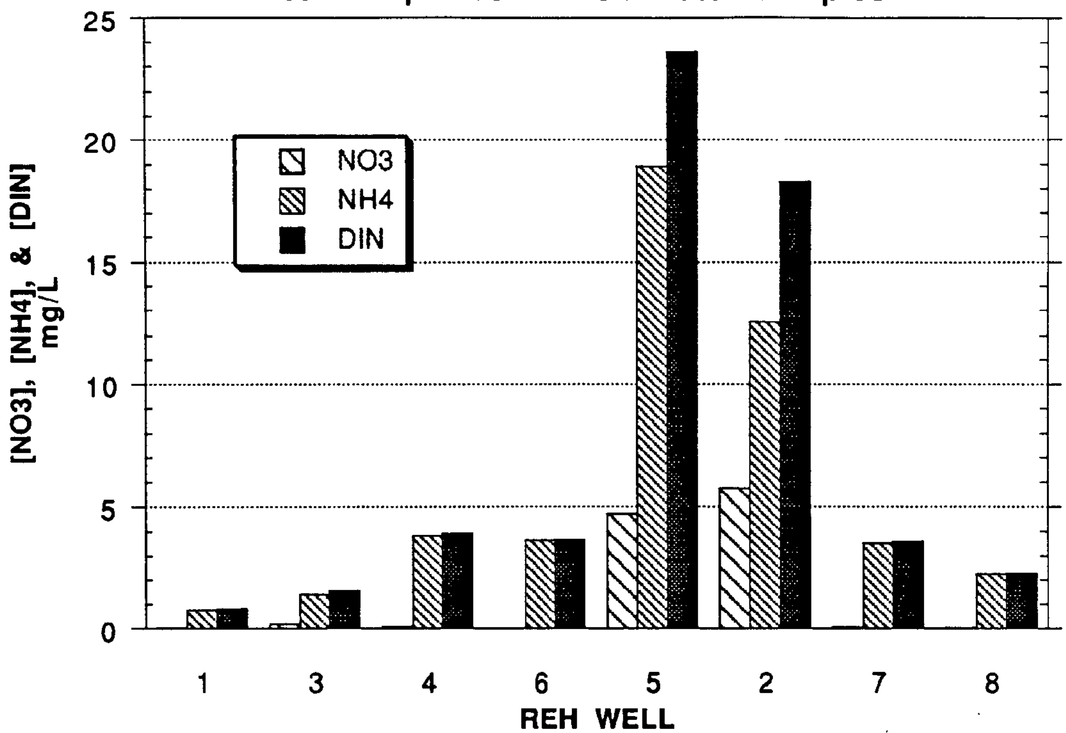


FIGURE 27B
SITE REH
Mean PO4 in Well Water Samples

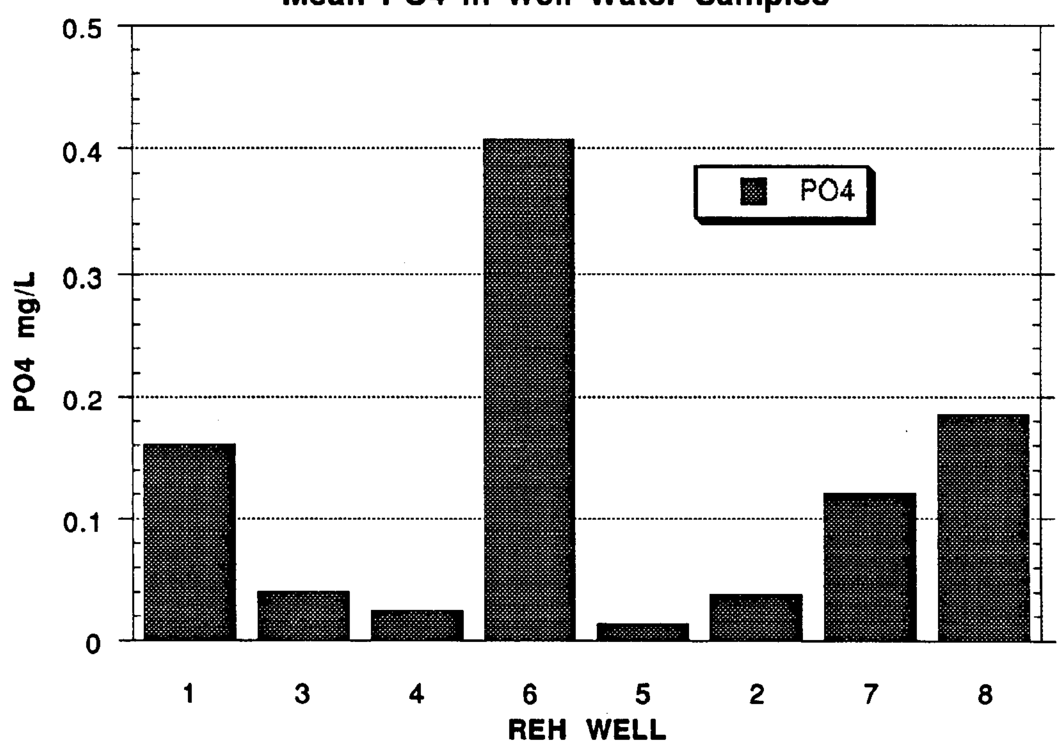


FIGURE 27C
SITE REH
Water Table Depth in Relationship to Bottom of EDA
March 1995 to May 1996
[Bottom of EDA assumed to be 2' BGS]

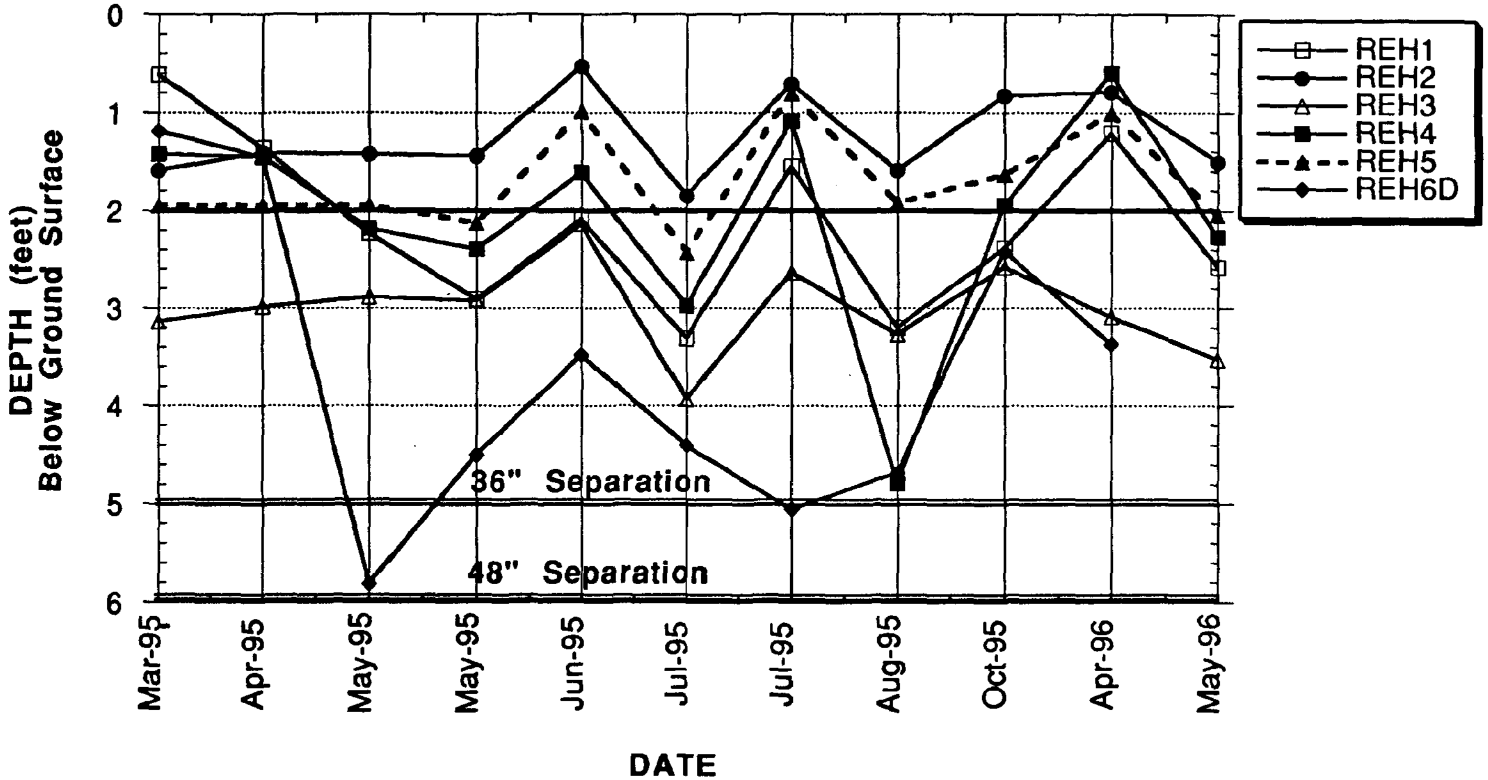


FIGURE 27D
SITE REH
EDA Treatment with respect to Groundwater Depth
December 1994 to May 1996

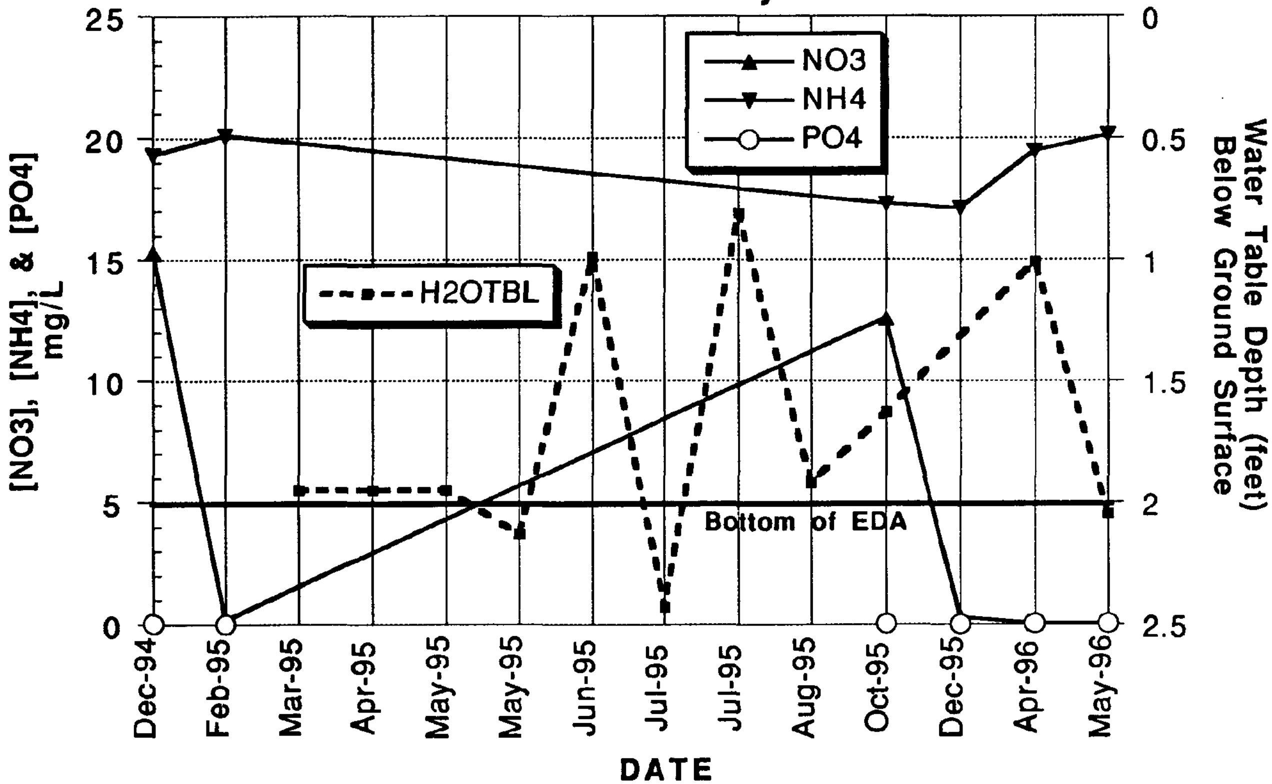


FIGURE 28A
SITE RET
Mean N-species in Well Water Samples

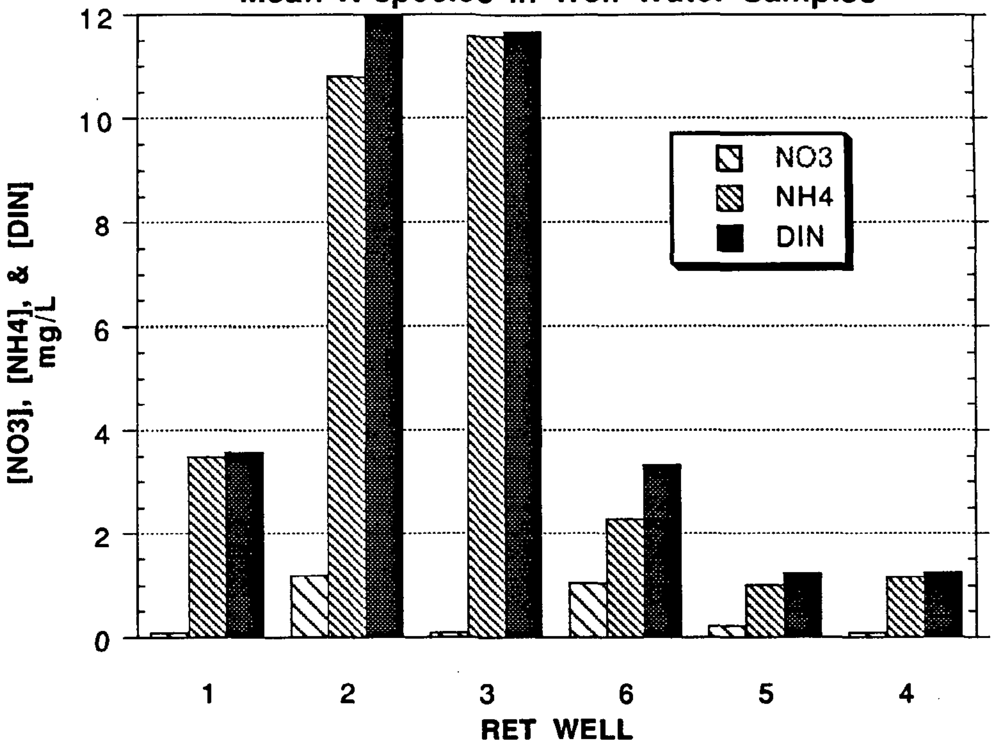


FIGURE 28B
SITE RET
Mean PO4 in Well Water Samples

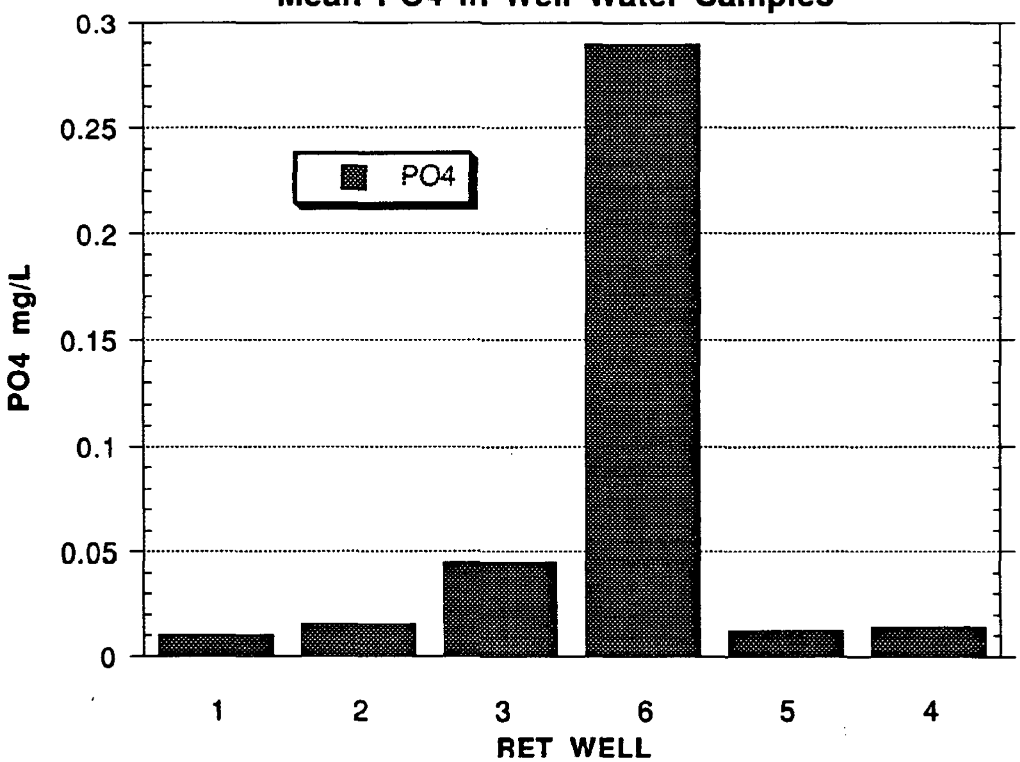


FIGURE 28C
SITE RET
Water Table Depth in Relationship to Bottom of EDA
March 1995 to May 1996
[Bottom of EDA assumed to be 2' BGS]

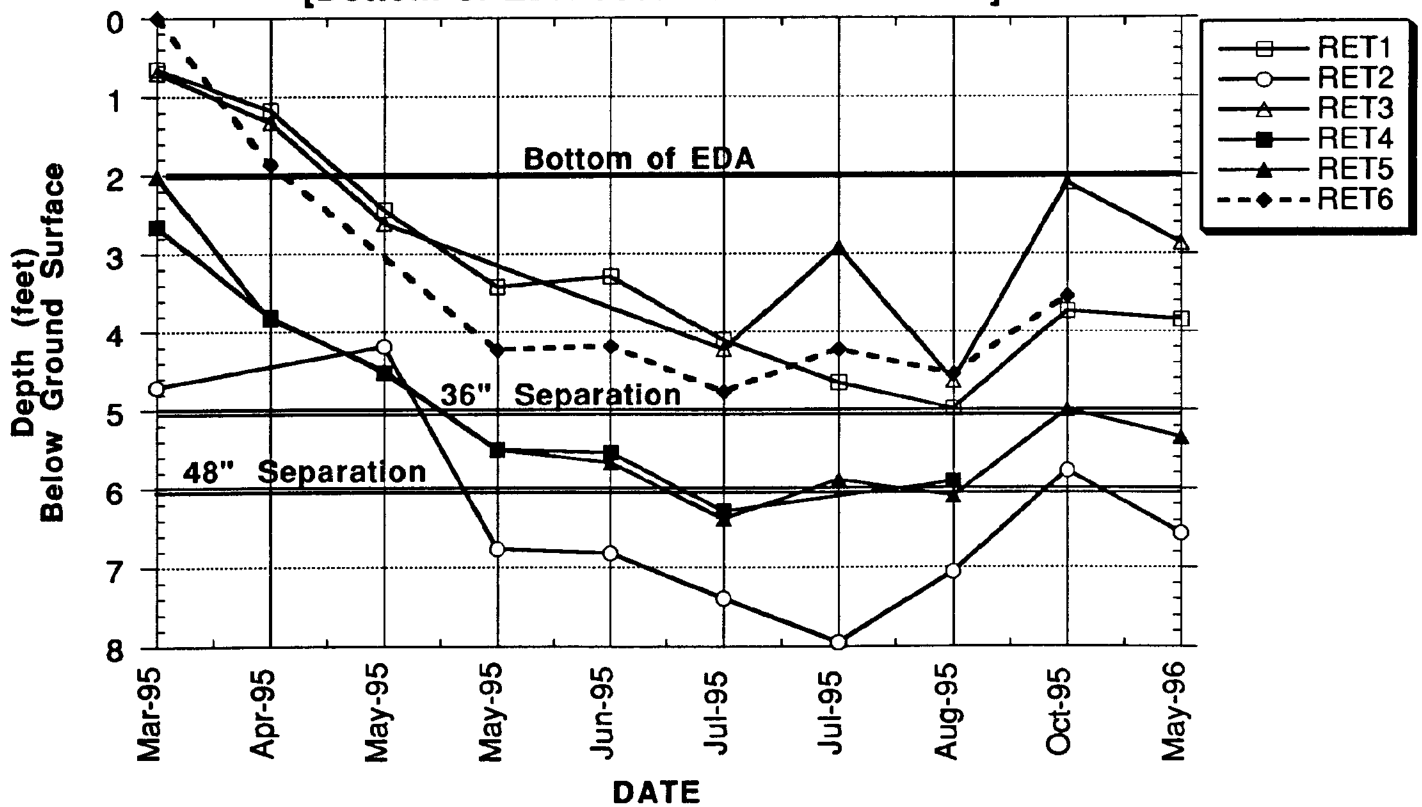


FIGURE 28D
SITE RET
EDA Treatment with respect to Groundwater Depth
December 1994 to May 1996

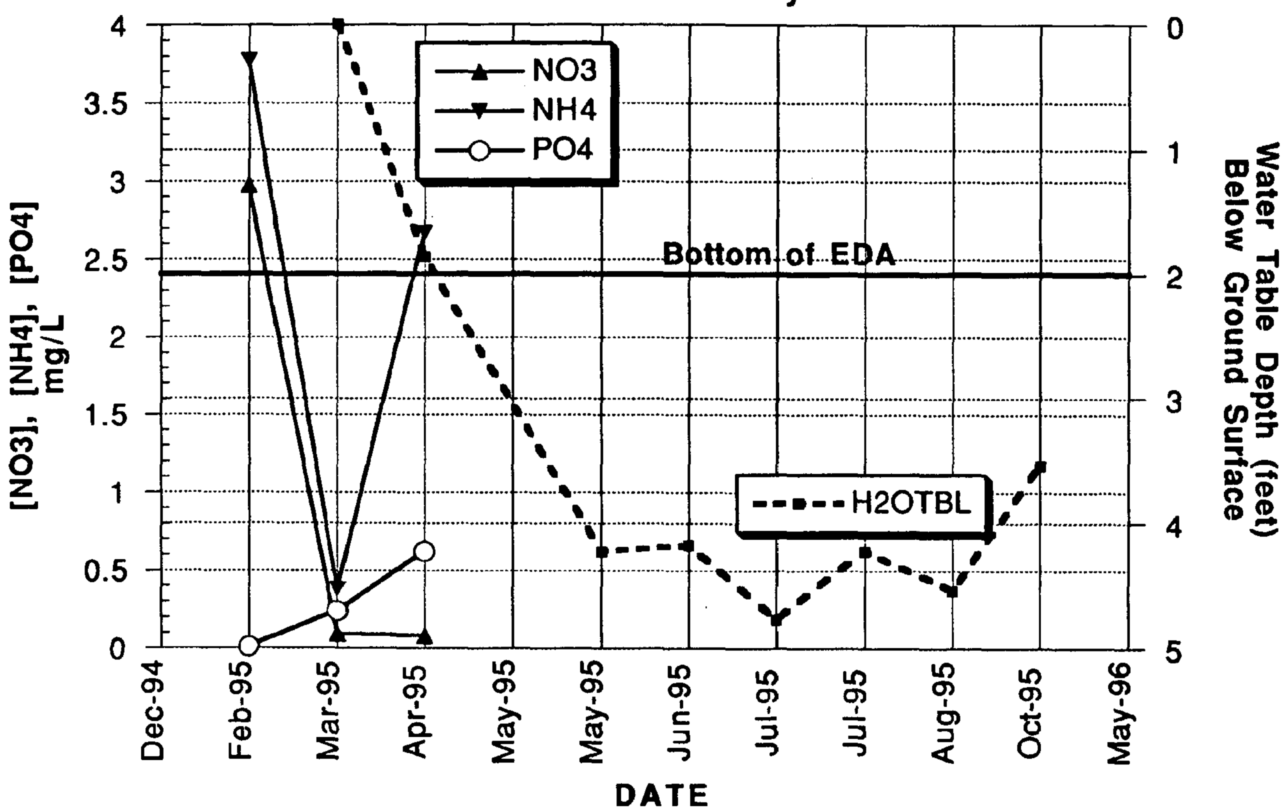


FIGURE 29A
SITE RB
Mean N-species in Well Water Samples

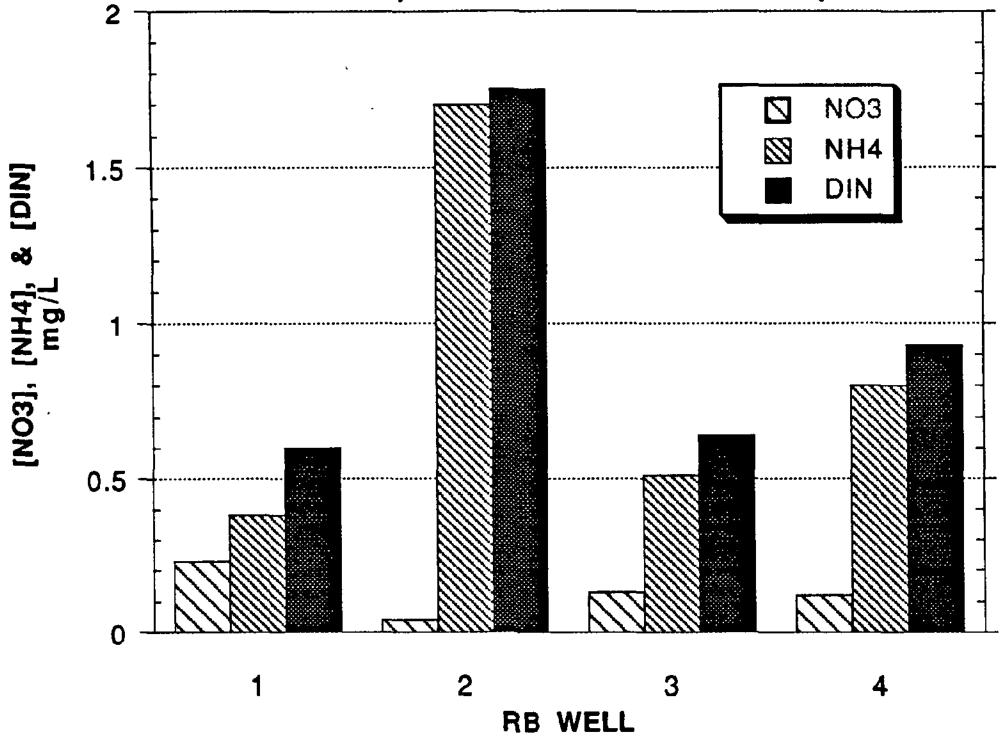


FIGURE 29B
SITE RB
Mean PO4 in Well Water Samples

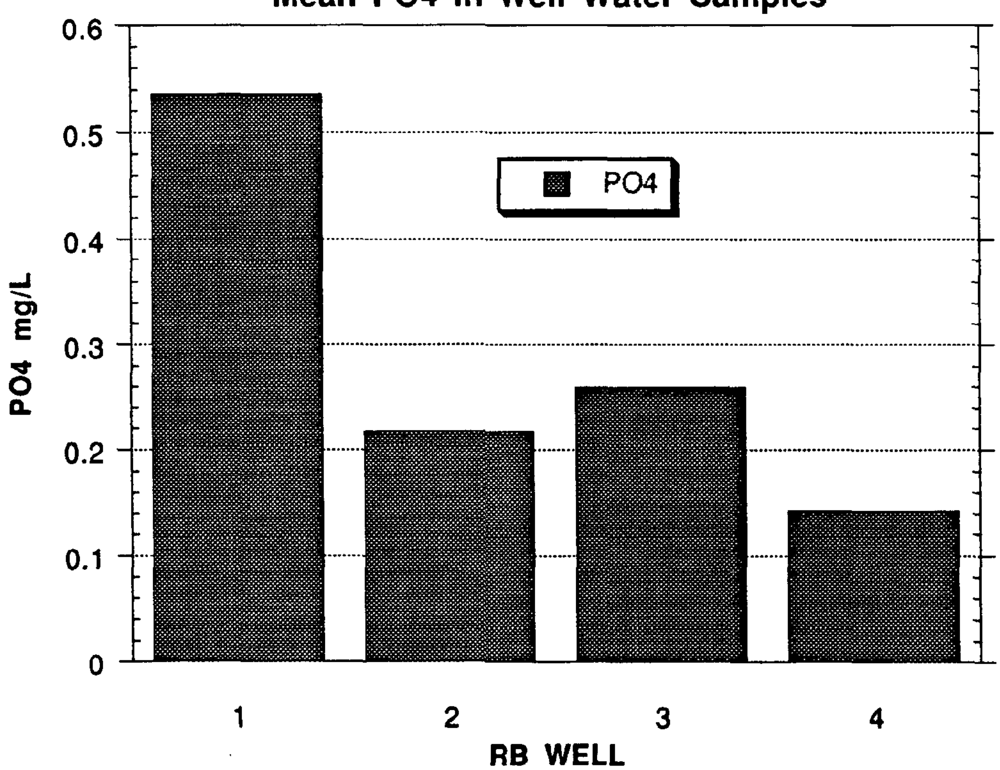


FIGURE 29C
SITE RB
Water Table Depth in Relationship to Bottom of EDA
March 95 to March 96
[Bottom of EDA assumed to be 2' BGS]

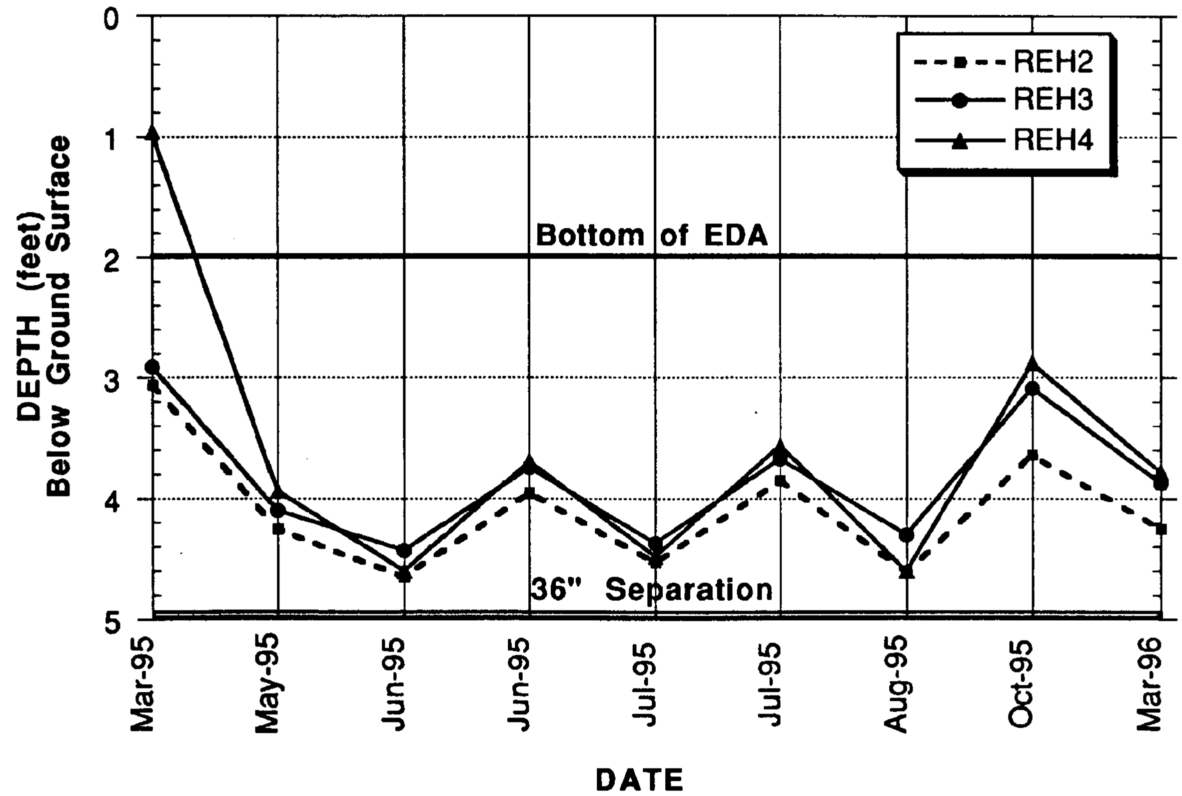


FIGURE 29D
SITE RB
EDA Treatment with respect to Groundwater Depth
December 1994 to March 1996

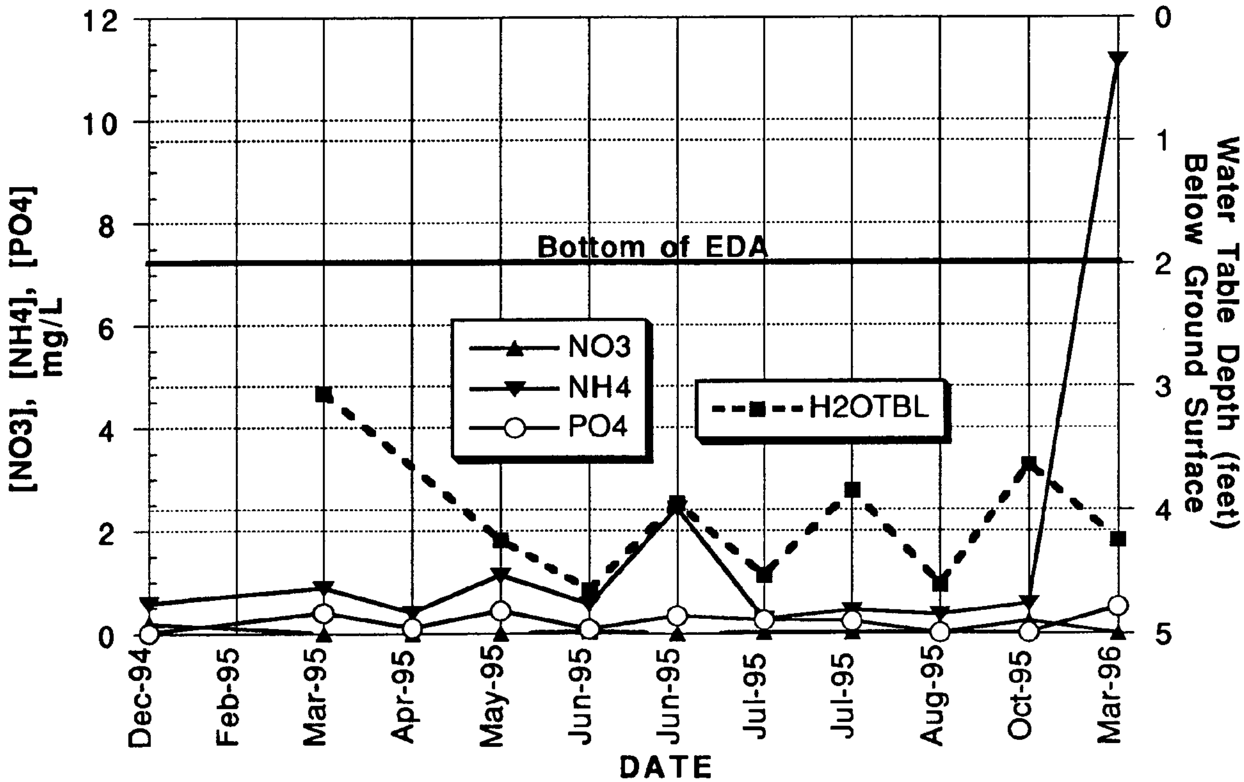


FIGURE 30A
SITE RH
Mean N-species in Well Water Samples

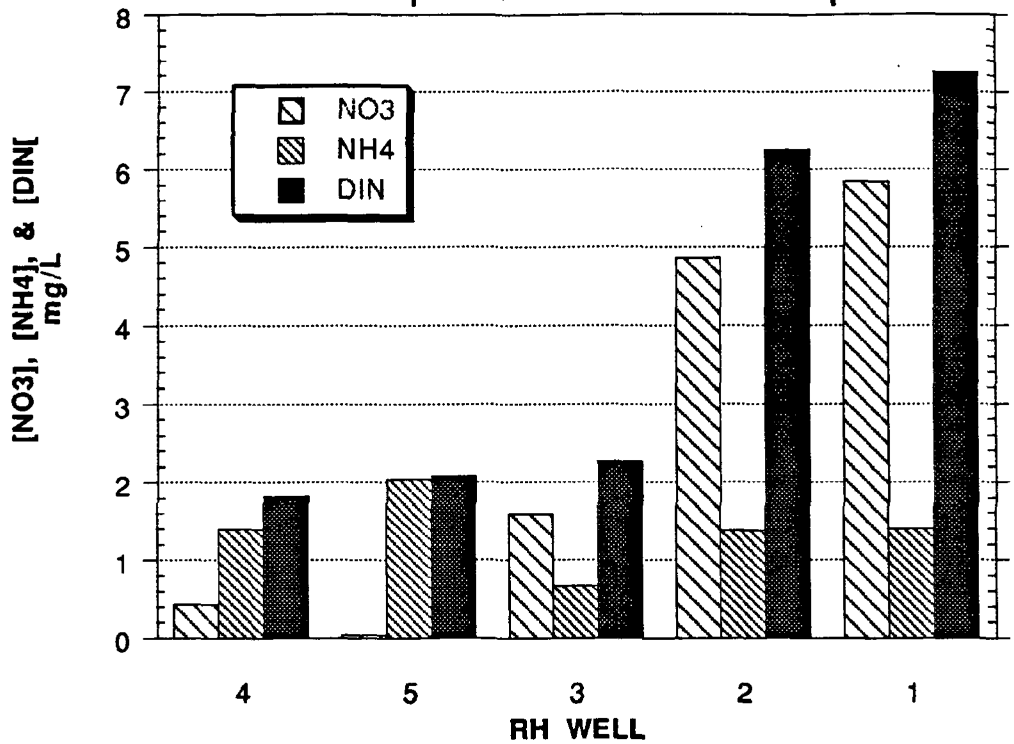


FIGURE 30B
SITE RH
Mean PO4 in Well Water Samples

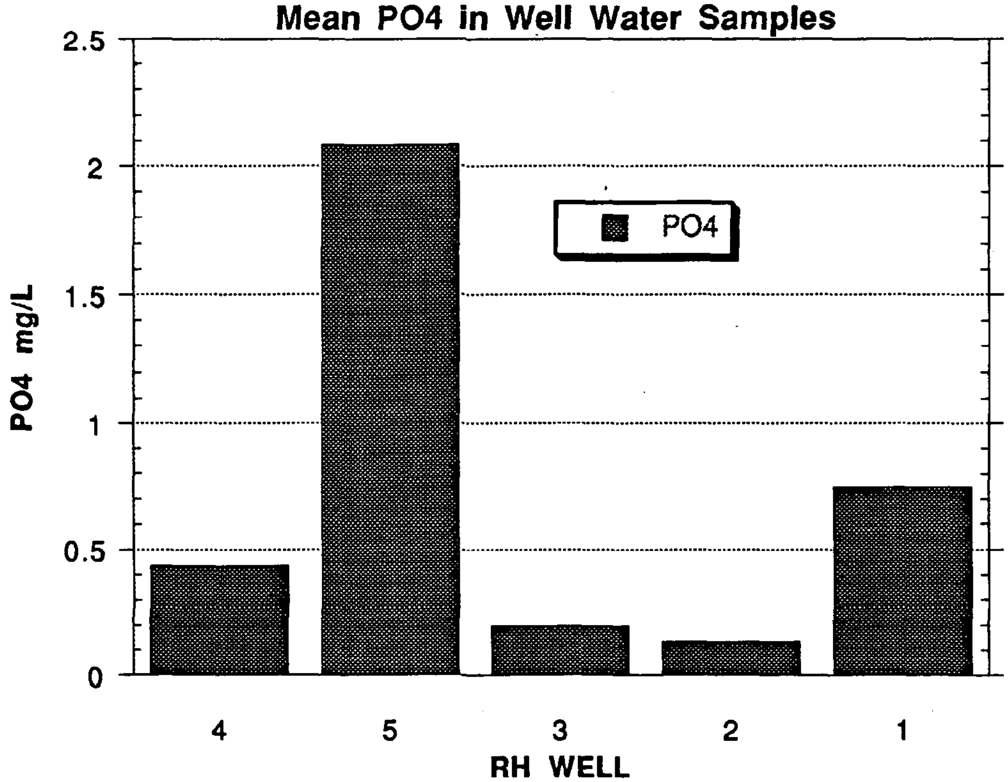


FIGURE 30C
SITE RH
Water Table Depth in Relationship to Bottom of EDA
March 1995 to May 1996
[Bottom of EDA assumed to be 2' BGS]

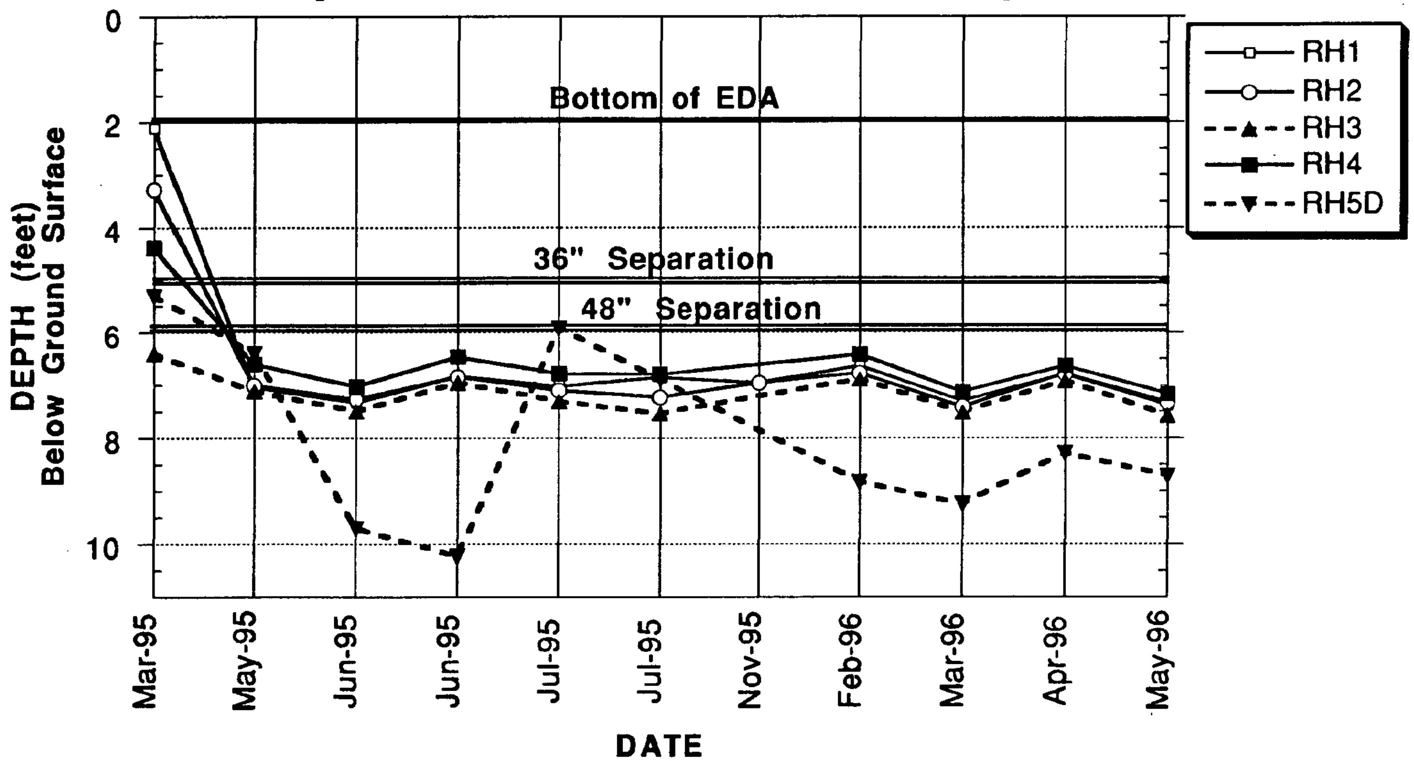


FIGURE 30D
SITE RH
EDA Treatment with respect to Groundwater Depth
December 1994 to May 1996

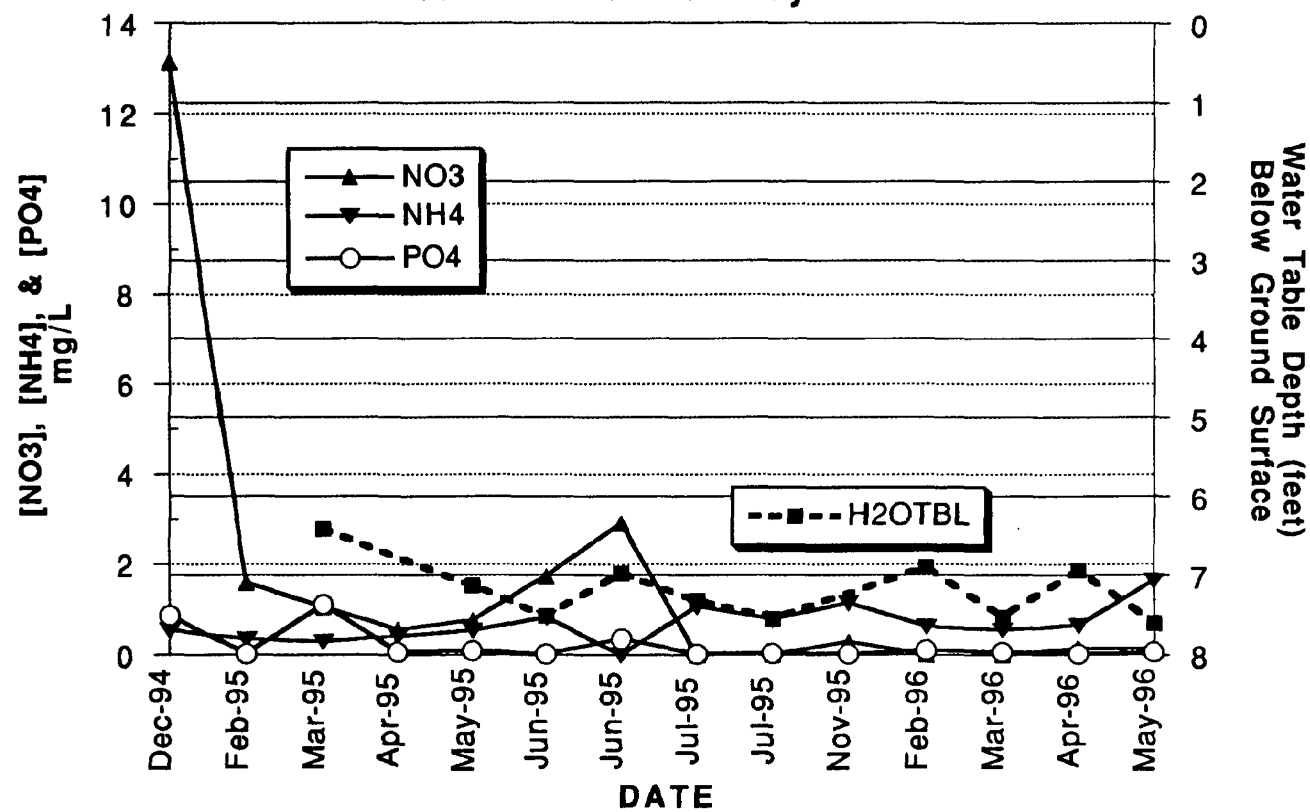


FIGURE 31A
SITE RP
Mean N-species in Well Water Samples

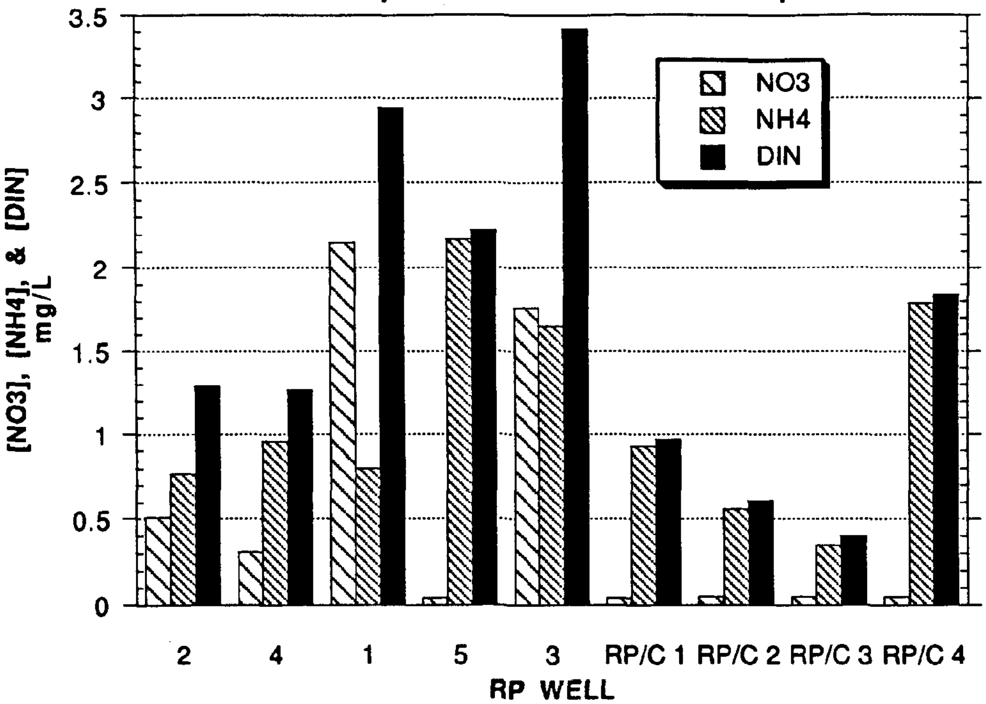


FIGURE 31B
SITE RP
Mean PO4 in Well Water Samples

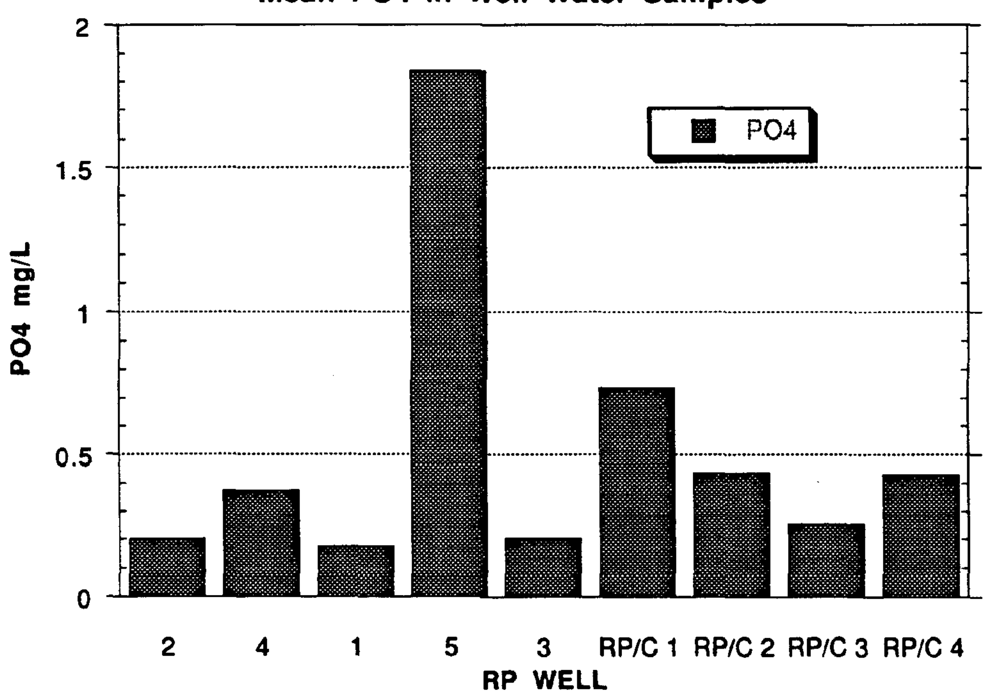


FIGURE 31C
SITE RP
Water Table Depth in Relationship to Bottom of EDA
March 1995 to April 1996
[Bottom of EDA assumed to be 2' BGS]

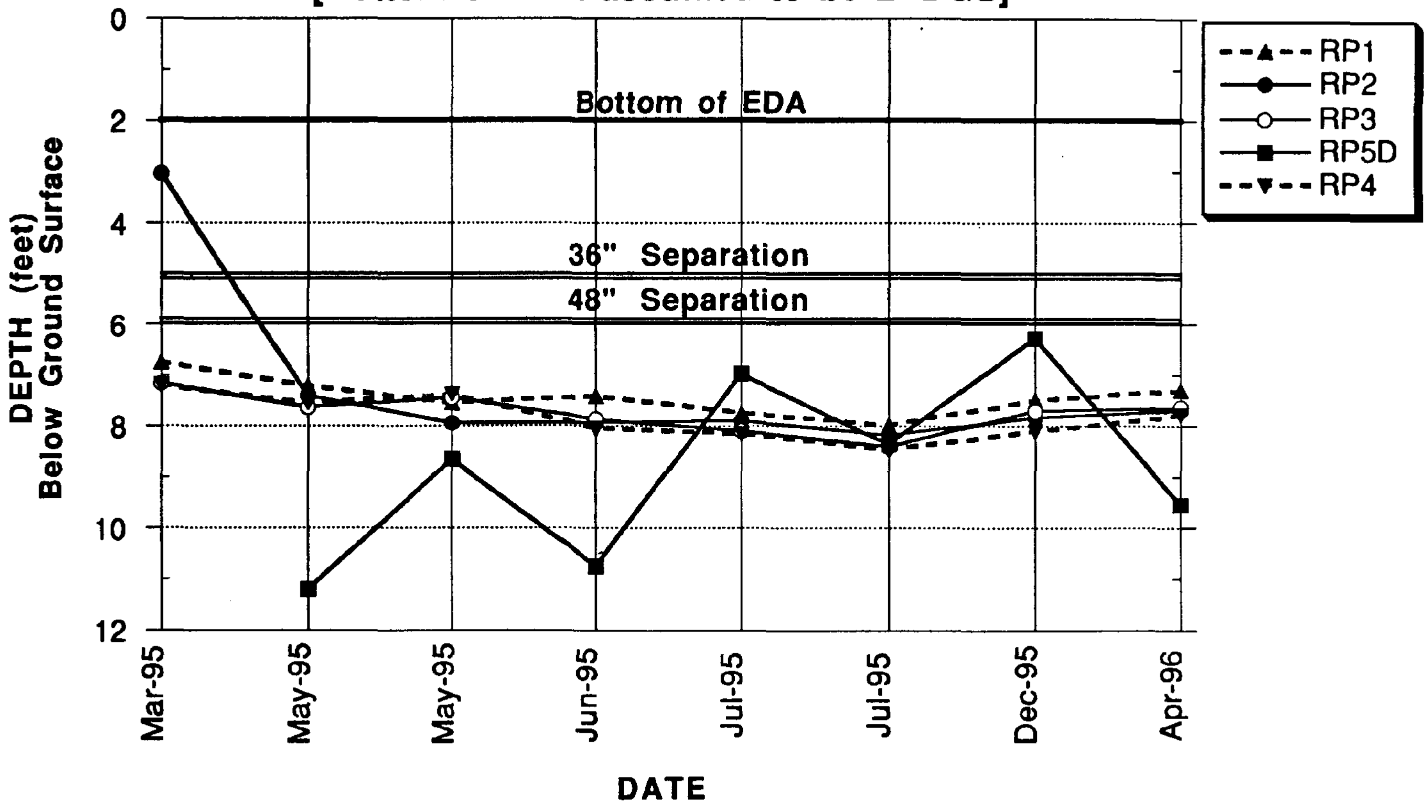


FIGURE 31D
SITE RP
EDA Treatment with respect to Groundwater Depth
January 1995 to April 1996

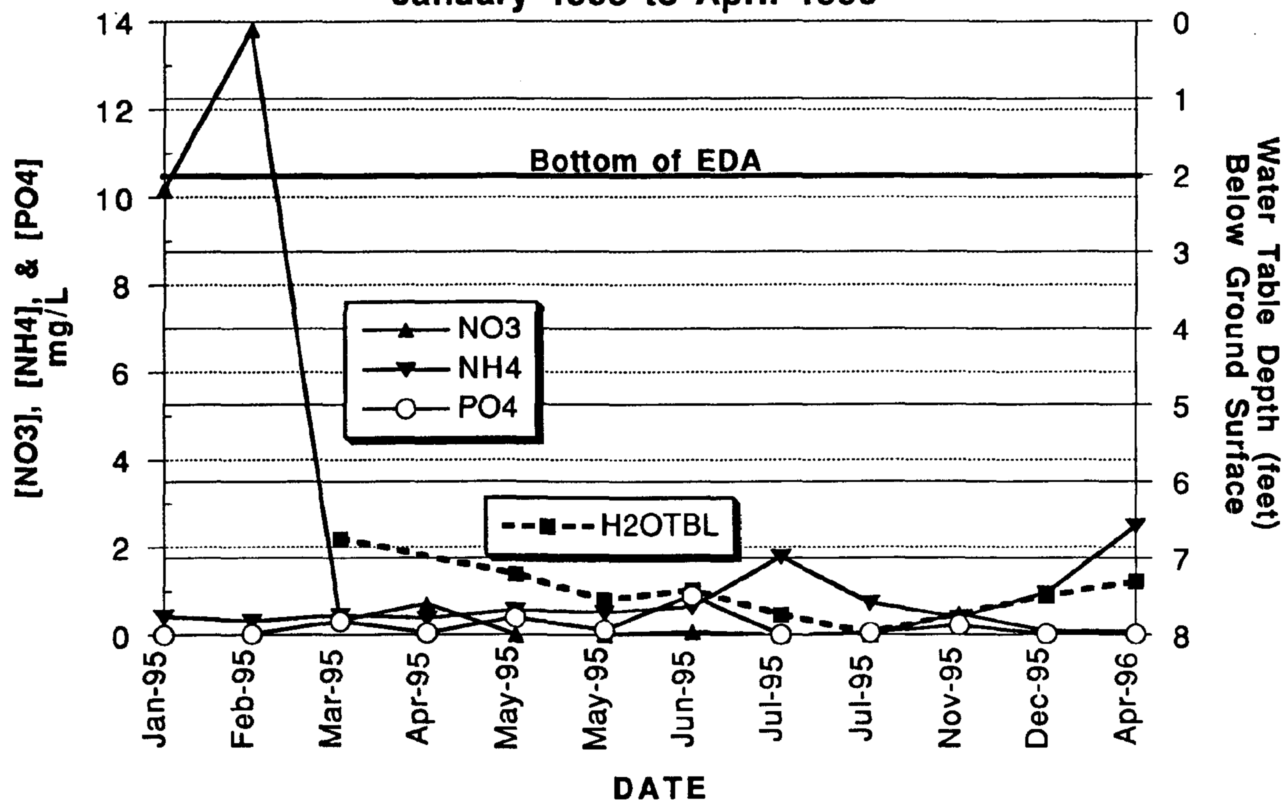


FIGURE 32A
SITE RC
Mean N-species in Well Water Samples

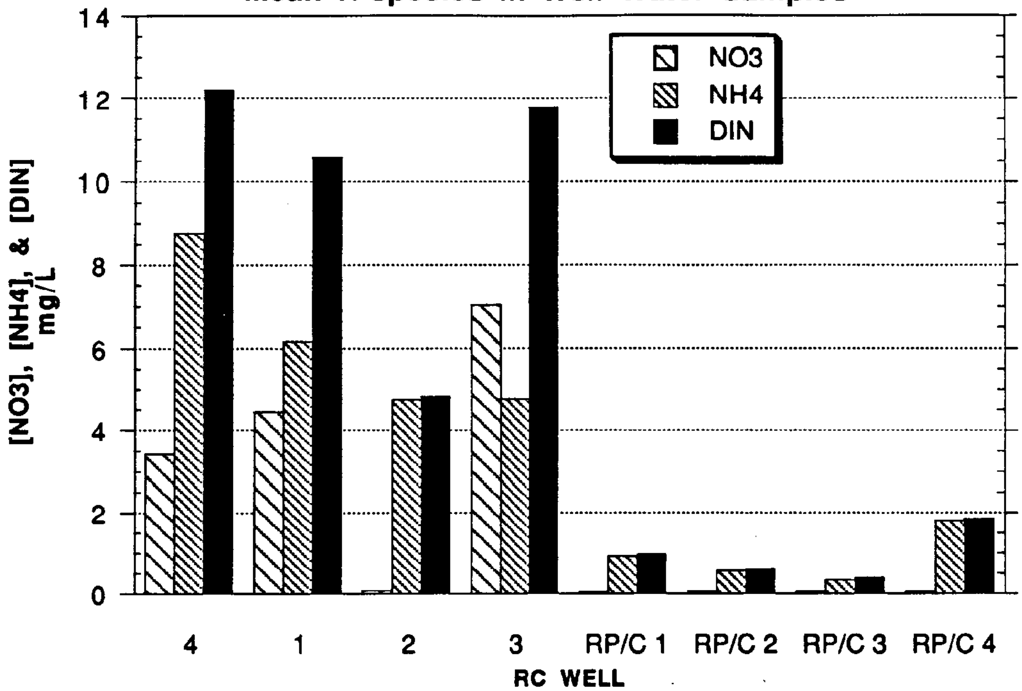


FIGURE 32B
SITE RC
Mean PO4 in Well Water Samples

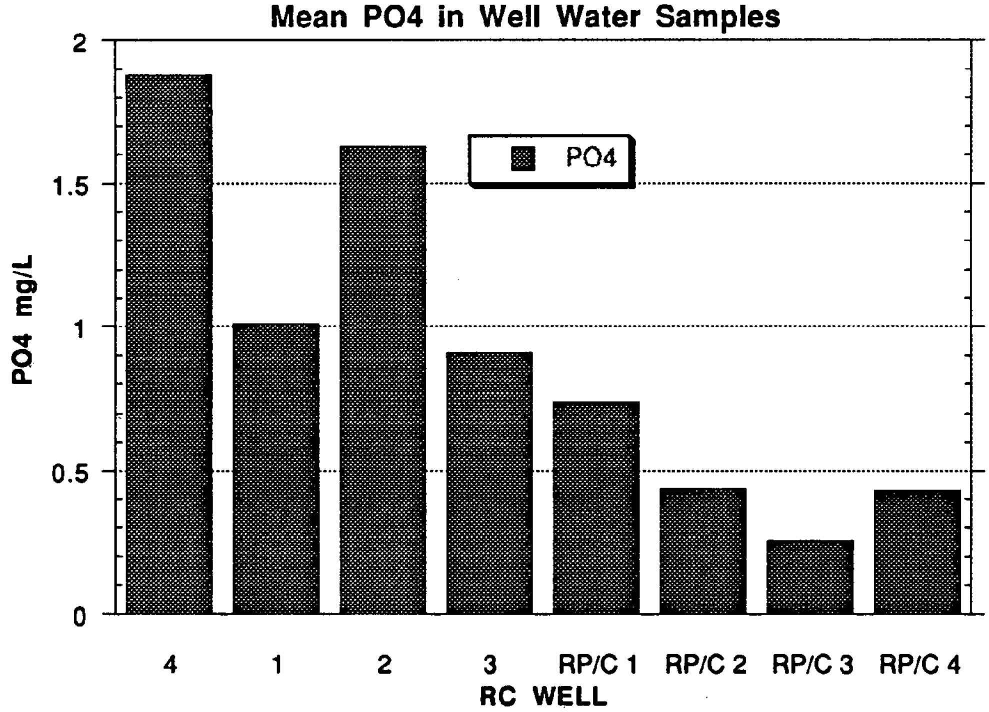


FIGURE 32C
SITE RC
Water Table Depth in Relationship to Bottom of EDA
March 1995 to April 1996
[Bottom of EDA assumed to be 2" BGS]

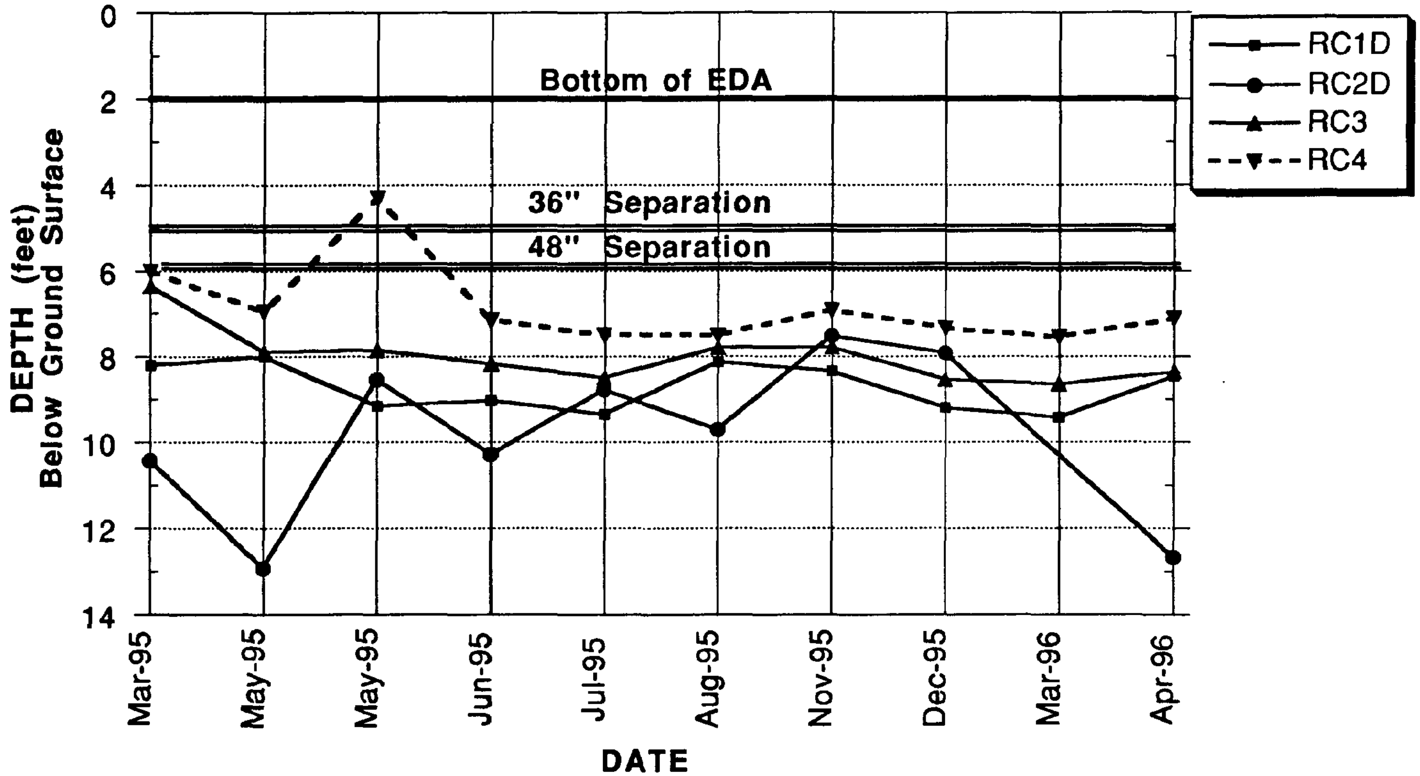


FIGURE 32D
SITE RC
EDA Treatment with respect to Groundwater Depth
January 1995 to April 1996

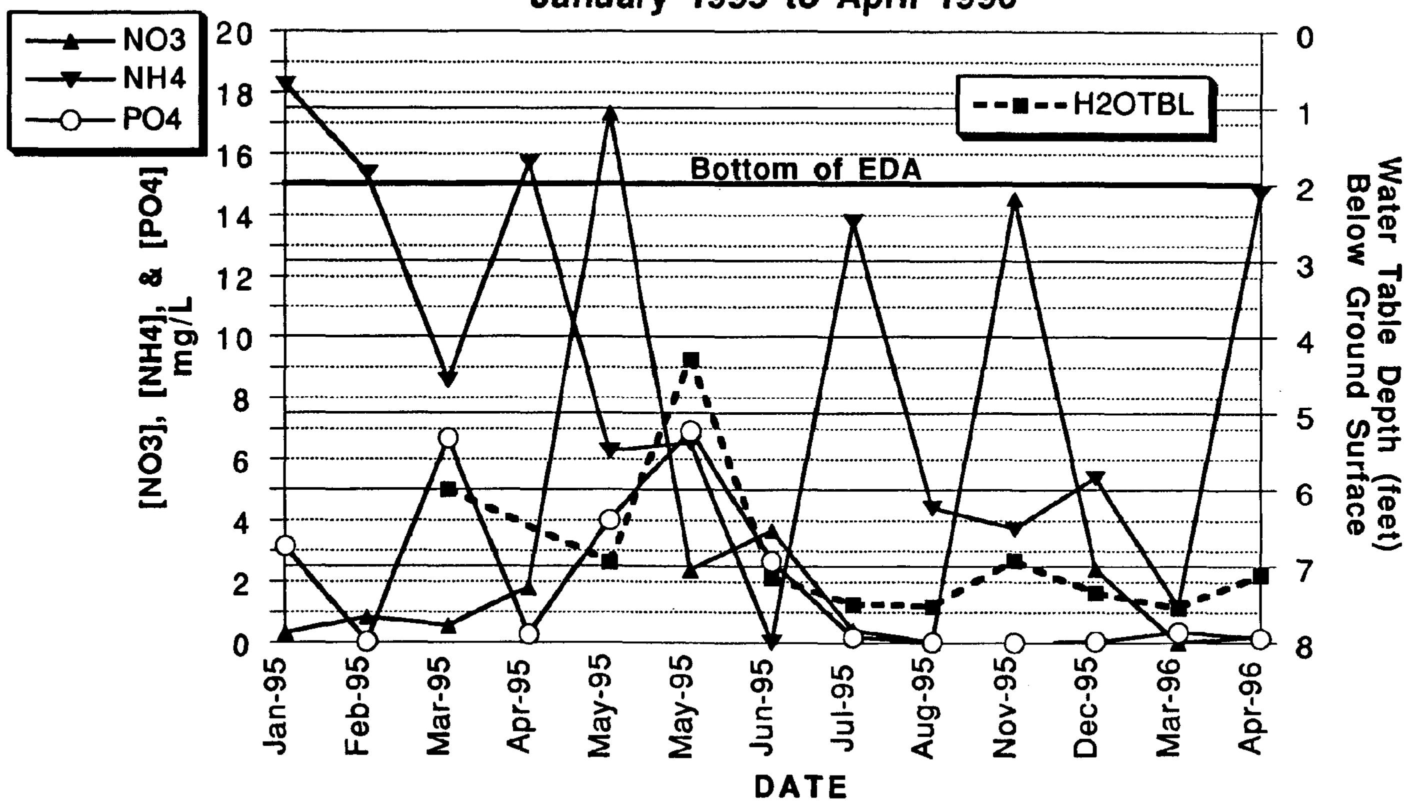


Figure 33. Geometric mean concentrations of dissolved inorganic nutrients in surface water from sites along transects of creeks and harbor sites around Hampton Harbor: 6/95-6/96.

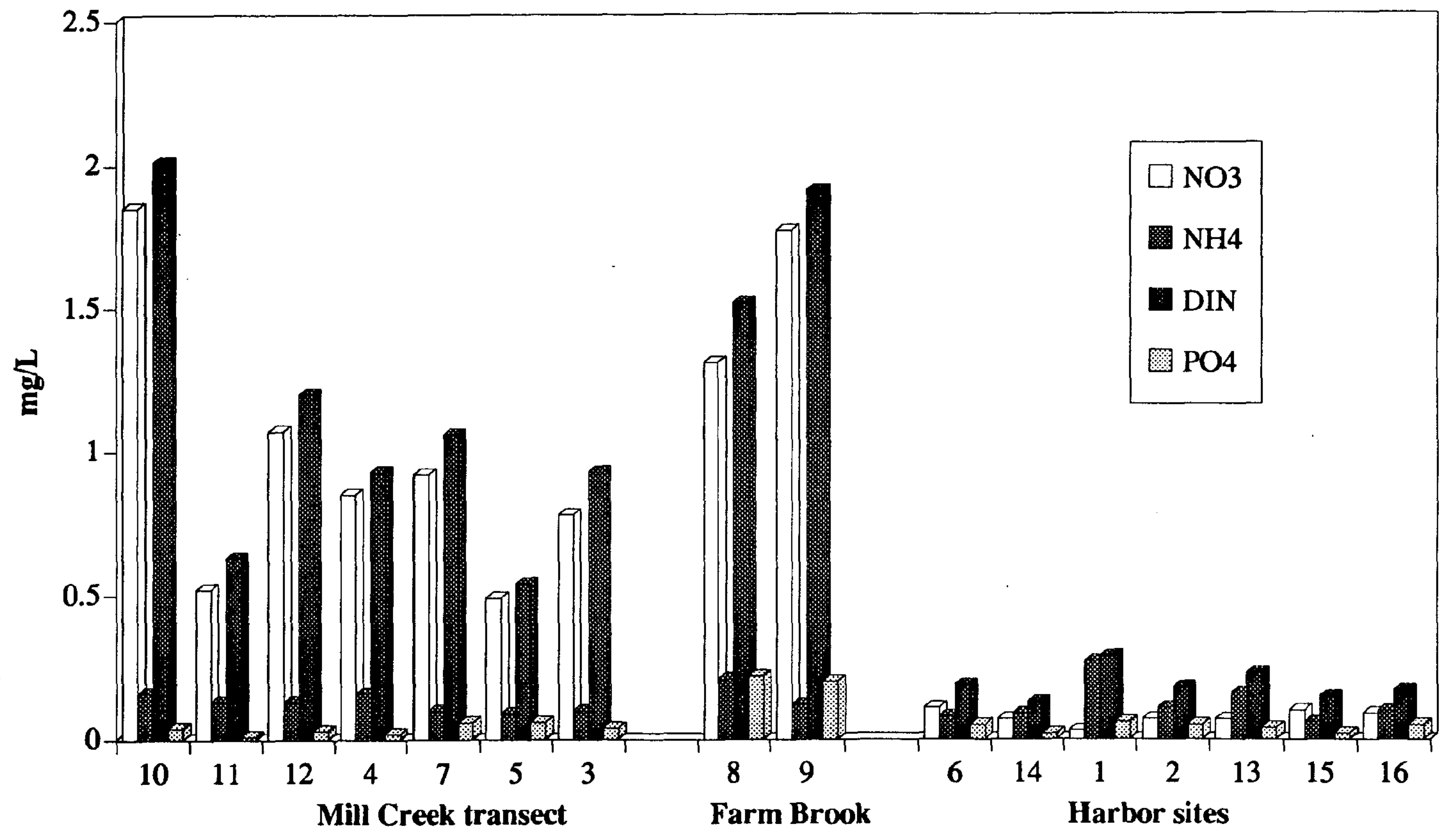


Figure 34. Geometric mean concentrations of bacteria in surface water from sites along transects of creeks and harbor sites around Hampton Harbor: 6/95-6/96.

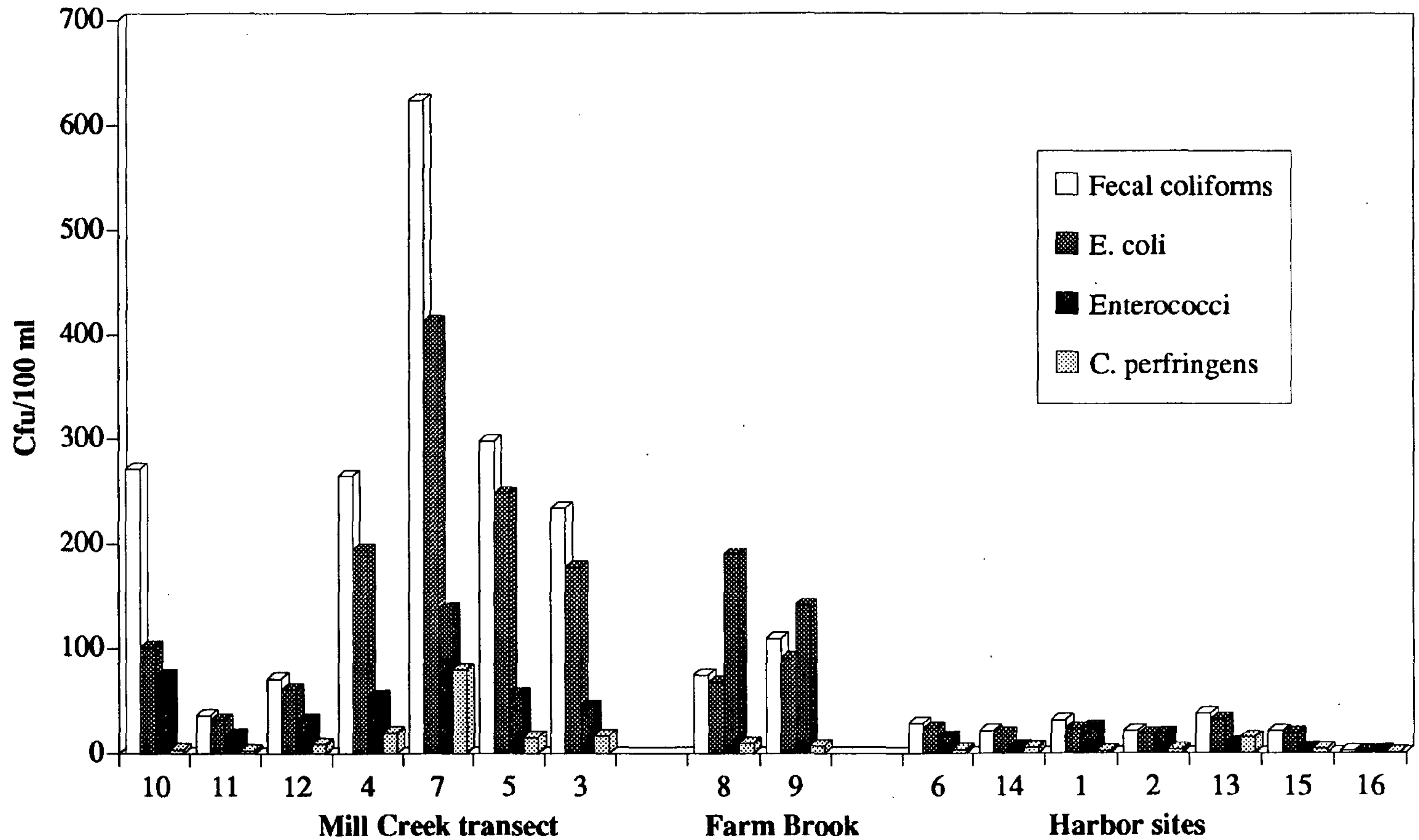


FIGURE 35.
Geometric mean concentrations of fecal coliforms, E. coli, and C. perfringens in soil cores taken from just above the water table along a transect at WRH, November 1995

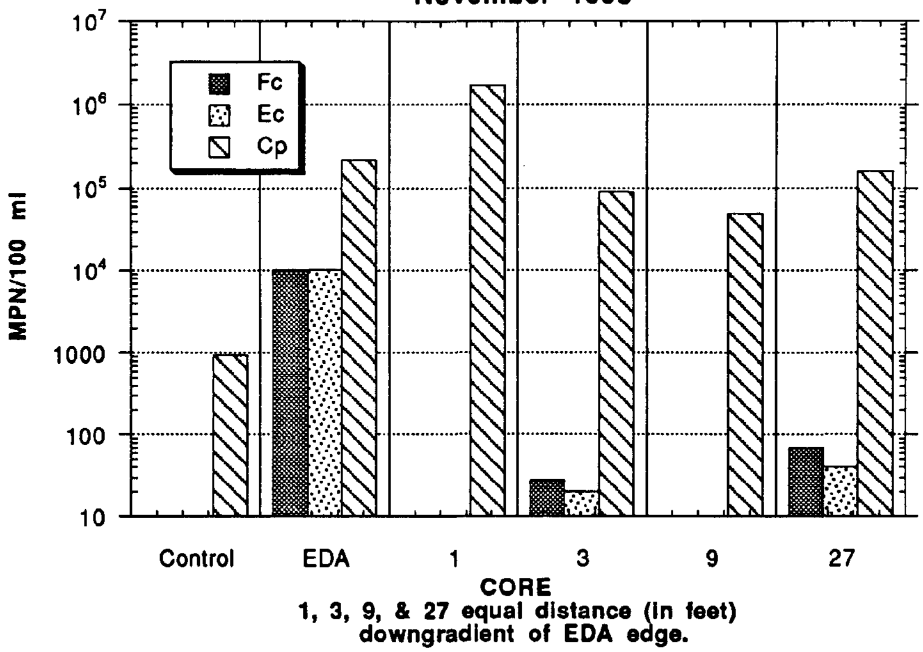


FIGURE 36.
Geometric mean concentrations of C. perfringens in soil cores taken above the water table in 3 transects at REH December 1995